Ethical Perspectives on Climate Policy and Climate Economics

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1 Introduction

1.1 Times Have Changed

I can vividly remember the reservations I had about the topic of climate justice before entering this field of research some years ago. Not that I doubted the significance of climate change or the importance of justice, each taken separately. It was the linkage I worried about. I assumed that mixing the two issues must be rooted in the unfounded assumption that for some mysterious reason all the various evils in this world – such as climate change, environmental degradation in general, poverty, or global inequality – must go hand in hand with each other.

My doubts were dispelled immediately on starting to engage seriously with this topic. It quickly became obvious that climate change truly presents us with a "perfect moral storm". Stephen Gardiner (2006b) used this expression in reference to a "perfect storm" on the North American Atlantic coast which was made prominent in popular culture by means of a movie with the same title. Just as the confluence of various weather-related phenomena combined to create this exceptionally hard storm, various moral intricacies join forces in the area of climate change to create an exceptionally grave moral issue. According to Gardiner, the three problems of dispersion of causes and effects, fragmentation of agency and institutional inadequacy to deal with the problem appear on both a global and an intergenerational level. These global and intergenerational storms converge with a theoretical storm: our ineptitude, given the state of moral theory which historically has not been concerned with problems of such a nature, to deal with issues

such as scientific uncertainty, intergenerational equity, contingent persons and non-human nature. A perfect storm indeed.

Moreover, it is not a storm in a teacup. The sheer size of the problem is staggering. Has politics ever seen the people of this planet meeting to divide among themselves a good of equal value as the "carbon pie" which is currently up for negotiation? What other policy-controlled risk in the last centuries has involved such a global and long-term scale?

Only a short time ago, these novel, weighty, and complex ethical questions associated with the emission of greenhouse gases were not common knowledge. After acquainting myself with them, I had to introduce them innumerable times over the past years to questioning colleagues and friends. But today, this is hardly necessary anymore. At the point of writing this introduction, negotiators are discussing the future of climate policy in Copenhagen and as can be witnessed from their speeches and from the newspaper editorials, familiarity with the moral facets of climate change is nowadays taken for granted.

These moral facets of climate change are the topic of this doctoral thesis. Chapters 2 and 3 discuss selected aspects of intergenerational justice as they arise in a specifically economic approach to climate policy.[1] Chapter 4 deals with aspects of global justice in mitigation and adaptation and it does so with particular regard to the relevance of historical emissions. In this introduction I will first give an overview of the questions of justice involved in climate change (section 1.2), followed by remarks on theories of justice in general and their application to the intergenerational context (1.3). I will then introduce the chapters (1.4 – 1.6) and close with comments about limitations (1.7) and about the interdisciplinary approach of this thesis (1.8).

[1] A more synoptical perspective on the moral questions which arise in the economics of climate change can be found in Meyer and Roser (2008) which is based on Meyer and Roser (2007).

1.2 Overview

Climate justice is concerned with a number of goods and bads: First, the benefits of pursuing activities which increase the emission concentration in the atmosphere or, respectively, the *mitigation costs* of foregoing these activities, second, the *climate damages* which are a side effect of these activities, and third, *adaption costs* for coping with these damages.

Four general features of anthropogenic climate change jointly define the basic set-up of problems faced by a theory of climate justice. Firstly, climate change is a *long-term issue*. A considerable part of the effect of greenhouse gas emissions materializes only after a time lag of several decades. Secondly, climate change is characterized by *uncertainty*. While there is little doubt that climate change will generally be detrimental rather than beneficial to humanity (and to a large part of non-human nature), there is large uncertainty about its exact extent. Thirdly, climate change is *disproportionally caused by people in developed countries*. Finally, climate change *disproportionally affects people in developing countries*.[2]

The complexity of climate science and its attending controversies can sometimes hide the fact that these core issues are subject to hardly any disagreement within current mainstream climate research. These issues – which are already sufficient to generate the intricate constellation of problems for climate ethics – can count as settled. They point to three central questions to be answered by a theory of climate justice:

How much mitigation?

The first question asks what global quota of emissions can be justified (for a certain time span). A number of considerations might be adduced to answer this question. First, duties towards non-human nature are a ground for limiting emissions. Second, given that the detrimental effect of emissions also

[2] For support of these basic points and for any detail beyond them, see the work by the Intergovernmental Panel on Climate Change (IPCC) which is widely accepted as an authority.

affects the emitters themselves, considerations of self-interest are a reason for capping emissions. Third, again taking into account the near-term effects of emissions, considerations of global justice – i.e. contemporaries harming contemporaries through emissions – are a further reason for restricting emissions. Fourth, duties towards future generations provide a justification for keeping the global emission budget sufficiently low. In this thesis, I will take the fourth point, i.e. intergenerational justice, as the central consideration for determining the size of a justifiable global quota. In chapter 2, I discuss the question of discounting in relation to intergenerational justice. And in chapter 3, I investigate the relevance of uncertainty for the specification of duties of intergenerational justice.

Who should bear the mitigation burden?

The second question takes the answer to the first question as a given and asks how the pre-determined emission quota should be split up among nations, regions, companies, or, ultimately, individuals. This can also be expressed as a question about the assignment of emission reductions relative to the status quo. Whilst I take the first question to be primarily a question of intergenerational justice, the second question is primarily a question of intragenerational global and social justice.[3] Chapter 4 deals with this question, with particular consideration given to the fact of unequal historical emissions of the North and the South.

Who should bear the adaptation burden?

Given a certain level of mitigation effort as determined by an answer to the first question, a corresponding degree of climate change will result. An answer to the third question then determines the extent of effort to be undertaken to cope with this change and the distribution of payments for

[3] It does not, however, lack an intertemporal dimension as well because the timing of a given amount of emission reductions is an open question.

doing so. Like the second question, this is mostly a question of global and social justice.[4] Accordingly, this question is also considered in chapter 4.

1.3 Distributive Justice

The three most important questions for theories of distributive justice typically are: distribute what, among whom, and how? Here, the how-question is in the spotlight. Conceptions which have been prominently discussed in recent debates are egalitarianism, sufficientarianism, and the priority view (cf. for example Holtug and Lippert-Rasmussen (2007) or Krebs (2000)). They all oppose utilitarianism by refusing to evaluate distributions soley in terms of whether goods yield the highest possible benefit. Prioritarianism and sufficientarianism can both be seen as reactions to problems of egalitarianism. Insofar as egalitarianism views equality as an intrinsic value, it runs into the "levelling down objection": In one respect it sees something better about a situation where everyone is equally badly off compared to a situation where some are badly off and some are well off. This reveals egalitarianism's principal concern to be comparative facts and not the absolute level of well-being of people. Prioritarianism, by contrast, does not deny that it is in all respects better that any given person has more benefits than less – even if this implies inequality – but it combines this view with the claim that it is more important for the less well off to receive benefits. This second point should not be equated with the idea of diminishing marginal utility in economics, i.e. with the idea that a given amount of a good yields more utility in the hands of a person who owns few goods. The idea is rather that a given amount of utility (or whatever conception of benefit one employs) itself is of varying moral importance depending on who receives it. Sufficientarianism suggests a different way to build a coherent theory out of our intuitions about distributional matters. It gives central importance

[4] It does neither lack an intertemporal dimension because the present generation can make investments into the adaptive capacity of future generations.

to a threshold and it can make both a positive and a negative thesis with respect to this threshold. The positive thesis claims that it is of utmost concern that people live above the specified threshold; the negative thesis claims that additional distributive demands (e.g. above the threshold) shrink to insignificance. Any of these approaches to distributive justice as well as utilitarianism can additionally take note of the instrumental value of equality.[5]

Chapter 4 takes the priority view to be a plausible theory for issues of global justice and applies it to the distribution of mitigation and adaptation burdens. Chapters 2 and 3 tackle issues of intergenerational justice and whilst I do not take an explicit stance in those chapters (in order to operate on as minimal premises as possible), I want to briefly mention some considerations which make a sufficientarian conception of intergenerational justice more convincing than its rivals.[6] Relations among humans of different generations exhibit a number of features which are absent from relations among contemporaries. The fact that the presently living can affect the existence, number, and identity of persons living in the future has philosophically perplexing implications such as the non-identity problem (made prominent in particular by Parfit (1984)). A plausible response to the non-identity problem which grounds the case for an intergenerational sufficientarianism is a threshold notion of harm and in particular a sufficientarian specification of this threshold. Besides the general problems of egalitarianism mentioned above, this can be based on the following arguments. Firstly, the case for egalitarianism among a certain group of humans sometimes relies on these humans cooperating with each other in a mutually beneficial way or their interacting in a common institutional structure, which they shape through collective decision-making. Such cooperation and interaction is not given

[5] A somewhat more extensive description of the contrast between these theories can be found in two texts not included in this thesis: Meyer and Roser (2006) and Meyer and Roser (2009).

[6] These considerations are laid out in detail in Meyer and Roser (2009)

among non-overlapping generations, or at least not in a straightforward way. Secondly, the priority view has the same problems as utilitarianism in the intergenerational context. If the number of future people is sufficiently large, it places unreasonably large demands on the presently living generation. Thirdly, and independently of the aforementioned, if we aimed at actually implementing a truly egalitarian conception of intergenerational justice, the downsides of the institutional structures necessary to achieve this ambitious goal – such as a world government or, more far-fetched, an eco-dictatorship – might far outweigh the desirable features of equality. Fourthly, and again on the practical side, the informational requirements for achieving sufficiency in the future are much lower than the requirements for achieving equality. It is much more difficult to guess the conception of the good of future persons living in completely different technological, cultural, and religious circumstances than it is to estimate what they need in order to have enough. Fifthly, instrumental grounds for equality – such as the social stability and the sense of community fostered by equality – are less important in the intergenerational context than among contemporaries. Finally, it is unclear whether a theory which demands nothing more than equality would leave enough reasons for generations who live below a subsistence threshold to make their descendants better off than themselves. It could thus justify a history without poverty-eradicating human progress. These considerations tell against a purely egalitarian or prioritarian approach to intergenerational justice and give reason to support sufficientarianism.

1.4 Chapter 2: Discounting

This chapter deals with the issue of discounting, which has recently come to new prominence as a result of the growing importance of economic models of climate change. It makes two claims about the appropriateness of discounting the utility of future generations. Firstly, it argues that discounting in the sense of ascribing a certain weight to the utility of future generations

("genuine discounting") is not only wrong but primarily unnecessary. Determining a discount rate in this genuine sense is only necessary within frameworks that implausibly prescribe weighing up the utility of present and future generations. Secondly, it argues that "non-genuine" discounting in the sense of taking into account opportunity costs, i.e. the fact that alternative investments to climate mitigation measures have positive rates of return, too, is justified. In addition, it argues that normative reasoning cannot be overlooked in the debate on discounting. To conclude, it suggests three reasons why the discussion on the discount rate is so perplexing.

The chapter is addressed to both political philosophers and economists but it is written so as to be largely comprehensible to people who are unfamiliar with the practice of discounting and economics in general. It aims at explicating the core issues, rather than pursuing various ramifications of the debate. It shares a common theme with chapter 3: Insofar as standard economics does lead to certain unacceptable conclusions, the main culprit is its underlying utilitarianism which is insensitive to deontological concerns.

Amongst the three chapters, chapter 2 is the one with the most direct application to policy-making. The balance of discounted benefits in the far future over present costs ought not to be a major consideration in choosing climate policy. Rather, mitigation targets should be set by reference to what we owe to future generations as determined by a theory of intergenerational justice and by reference to the returns of investments other than climate mitigation.

1.5 Chapter 3: Uncertainty

This chapter discusses the large uncertainties about the future which play a central role in climate policy. Proponents of the "precautionary principle" typically suggest that the risk-aversion which standard economics justifies by means of the curvature of the utility function is not enough. The chapter argues that we can make sense of the vague intuition which underlies these

calls for a precautionary principle if we replace the utilitarianism of standard economics by a rights-sensitive approach. Respecting the rights of future generations yields an additional reason for risk-aversion based on how the utility of future generations enters the present generation's choice problem. In order to argue for this claim, three alternative models of capturing rights in a formalized model are presented. They all diverge from the standard utilitarian objective of maximizing aggregate utility. According to these models, the concerns of future generations enter the choice problem of the present-day decision-maker in a different way than the present-day decision-maker's own concerns. Compared to furthering his own utility, the present-day decision-maker must give high importance to avoiding the downside risk of violating the rights of future generations while it may give low importance to the upside risk of benefiting future generations beyond the fulfillment of rights. This asymmetry makes for the risk-aversion inherent in rights-sensitivity.

The chapter is adressed primarily to an audience of economists. It is intended as an explorative enterprise. Because the normative ideals of utilitarianism are captured much more easily in formal language than deontological concepts, and because economics was so successful at investigating decision-making based on a utilitarian logic over the past decades, important territory has been left unexplored. Carried by the conviction that decision-making based on a respect for rights cannot be discarded (both from the point of view of common sense morality as well as from the point of view of prominent positions in critically reflected morality), I ventured into this insufficiently explored territory. My goal was to examine options for representing central features of non-utilitarian decision-making and to examine their implications.

The chapter could be extended in several directions. One might apply the three proposed models not only to risk-aversion but also to prudence (in the technical sense, cf. Eeckhoudt and Schlesinger (2006)). It might also be valuable to examine further the reasons for the difficulty of rep-

resenting trade-off resistance. Another avenue for future research might consist in transforming the normative conclusions into empirical hypotheses and in experimentally investigating the relevance of rights thinking for risk-aversion.[7]

Except for its support for our precautionary intuitions, the chapter is not primarily intended to be directly applicable to policy-making. Rather, it sends two messages to the discourse on the relevance of scientific uncertainty for climate policy. Firstly, it adresses theorists who are accustomed to the paradigm of expected utility theory and it argues that their approach is insufficiently risk-averse. Secondly, given that the basic logic of deontological thinking already constitutes a straightforward and weighty reason for cautiousness in the face of risk, the chapter questions the value of the search in the current literature for further and sometimes far-fetched rationales for a precautionary principle.

1.6 Chapter 4: North-South Justice

The final chapter is co-authored by Lukas Meyer and myself.[8] It discusses justice in mitigation and adaptation, giving special consideration to the fact of unequal historical emissions between the North and the South. Climate change can be interpreted as a unique case of historical injustice. It intersects intergenerational justice and global justice in a specific way. The chapter answers two questions: First, how should emission rights be distributed? Second, who should bear the costs of coping with climate change? The first question is treated as belonging exclusively to the domain of distributive justice. The chapter argues, on prioritarian grounds, that the developing world should receive higher per capita emission rights than the developed world. This is justified by the fact that the latter already owns a larger share

[7] Some points which are left unexplored in the chapter have been discussed in two manuscripts (Roser (2008, 2009)).

[8] A few topics mentioned in the chapter, such as emissions trading and grandfathering, are discussed at somewhat greater length in an earlier article co-authored by us (Meyer and Roser (2006)).

of benefits associated with emission generating activities because of its past record of industrialisation. At first glance, the second question appears to be an issue of compensatory justice. However, after defining compensation, it is shown that different kinds of compensatory principles run into problems when used to justify payments by historical emitters of the North to people suffering from climate change in the South. As an alternative, the chapter proposes to view payments from wealthy countries for adaptation in vulnerable countries as a measure based on concerns of global distributive justice.

The chapter is addressed to political philosophers. In comparison with the other chapters, it goes into greater detail and devotes more time to examining various ramifications of the discussion. Its relevance for matters of policy is clear: past and current (and on realistic expectations: future) patterns of emissions and climate policy are unjustly disadvantageous to the South and unfairly advantageous to the North. This conclusion is hardly surprising. The importance of the chapter lies in giving a sound foundation for this conclusion, by revealing how various considerations all point in the same direction and also in making clear which arguments can *not* be adduced to support this conclusion.

1.7 Limitations

I conclude the synopsis of the chapters with a short and non-exhaustive list of topics which are absent from this thesis. This serves as a disclaimer in that their absence is in no way meant to indicate their irrelevance for a complete theory of climate justice. Firstly, this thesis is about justice among humans rather than the appropriate treatment of non-human nature by humans. Secondly, I generally work with the simplified model of two or three, possibly non-overlapping, generations rather than with the realistic picture of humans continuously entering and leaving the existing population. Thirdly, there are important issues of justice which cannot be captured by a

coarse-grained distinction between the North and the South. Justice among individual persons characterized by a more detailed description than their belonging to a certain region of the planet is left as a topic for future work. Fourthly, population growth is not discussed. Fifthly, the legitimacy and feasibility of emissions trading are not discussed. Sixthly, it is crucial to have answers to questions about justice in transition and to questions of "non-ideal" theory (cf. for example Swift (2008)), i.e. answers which yield action-guiding results concerning the appropriate first steps in reducing the justice deficit in a world characterized by less than full compliance, limited motivation, institutional inadequacy, etc. Seventhly, moral demands for change in personal lifestyles rather than political solutions are not discussed.

1.8 Interdisciplinary Research

This doctoral thesis was a project in the Graduate Programme for Research in Interdisciplinary Ethics, it is submitted to the Department of Economics, its main focus are questions in normative ethics, and it is adressed to audiences in both economics and moral philosophy. It is thus interdisciplinary in many respects.

Interdisciplinary research is attributed a very positive aura these days. But engaging in it is often less straightforward than one might hope. Surprisingly, the main challenges are not the different subject matters or the different methodologies of the various disciplines. The main challenge is the different mindset prevailing in the different departments. What seems obvious and easy in the perspective of people trained in one area, seems controversial and intricate to people trained in another, and *vice versa*. Interestingly, I was able to observe the distance between the unquestioned background assumptions and basic paradigms reigning in the hallways of different departments in my own biography. Some years after shifting from economics to philosophy as my main focus, positions which seemed unthinkable or irrelevant to me slowly metamorphosed into plausible and relevant

positions. In order to be understood and taken seriously by one discipline, it is sometimes necessary to generalize crudely in the eyes of the other (note, however, that this can also serve as a cheap excuse). Interdisciplinary work is not a safe business. It has more resemblance to investments into venture capital than into government bonds: A large part of the effort is fruitless (note, again, that this can serve as a cheap excuse), but the occasional positive output often turns out to be a true pearl. These pearls are not the only justification for engaging in the effort. Interdisciplinary research is also important because the public has a legitimate interest for disciplines which treat the same subject matter to stay within earshot of each other. This enables them to give a unified picture of their subject or else to speak a sufficiently common language which allows them to explain why they diverge. Also, whole disciplines can get trapped in unhelpful paradigms and interdisciplinary work can be instrumental in stirring up such situations and opening up new directions. Finally, work at the interface is of course important because different disciplines use each other's output as input in their own field of study.

In any case, I enjoyed the crossing of boundaries in writing this thesis. And I hope the reader will enjoy the result.

2 Discounting and its Discontents

2.1 Introduction

There is a small, inconspicuous parameter in the midst of many lines of formulae in economic models of climate change that generates hot debates. The discussion of this number made it into the popular press and forced economists to delve into moral arguments and conversely prompted moral philosophers to work on mathematical expressions. Both sides found each other amateurish at times and even professional commentators made mistakes (cf. Quiggin (2008, p. 201)). The parameter in question is the discount rate. This number expresses how much less something in the future counts than the same thing today.

The real-world relevance of this technical debate should not be underestimated. The choice of the discount rate dwarfs almost any other aspect of economic models of climate change. These models can be further refined or increasingly sophisticated, but when it comes to the results they yield, the scientific and philosophical disagreements about the discount rate make all the difference. Many economists – most famously, William Nordhaus – are on the side of those who warn against rash or costly action against climate change. Other economists – most notably, Nicholas Stern – call for urgent action. Their disagreement is above all explained by their different choice of discount rates. This choice has huge effects: William Nordhaus (2008, ch. V) estimates the net cost of basing policy on Stern's views to be around $20 trillion relative to the policy determined as optimal in his calculations. Tol (2008, p. 3) demonstrates that a discount rate of 0% estimates total

damage from a ton of CO_2 to be more than ten times higher on average than a discount rate of 3%.

When economists calculate the costs and benefits of climate change this is more than "academic gymnastics": They are *heard* in the policy arena. Particularly, in the United States, cost-benefit analysis is given high priority. The Stern report had a huge impact on the media and served as an authority in innumerable arguments made on behalf of stringent climate policy.

What about this number has the potential to bring about so much discussion and disagreement? If a climate economist has to express the damage done by a ton of CO_2, he will come up with an estimate of the damage it does each year and add those damages up. In adding up, he will value damage done in the future much less than damage done today. With a discount rate of 3%, damage of 100 units in 100 years will be valued as only about 5 units today. Many economists will go on to claim that preventing damage of 100 units in 100 years is therefore not worth more investments into mitigation measures than about 5 units today – otherwise the net present value of the measure would be negative. If we scale up the length of the time frame and calculate how much it might be worth to prevent catastrophic climate change, which, say, wipes out half of global welfare in 200 years, then by the same reasoning such catastrophic damage would only be valued today at less than 0.25% of the damage it would do in 200 years. According to this logic, it seems that such a catastrophe is not worthy of much attention. But this kind of thinking is shocking to many. Damages in the future, so it seems, should not be seen as less important than damages in the present simply because they accrue at different points in time.

But is this really so? In many cases, valuing one and the same good differently depending on time seems completely natural. Imagine that you find out that 100 years ago your mother borrowed $5 from your neighbour and that you now want to give the money back to your neighbour's family. How much should you give back to them? If your neighbours had kept the $5

and had invested the money at an interest rate of 3%, it would have grown to around $100 today. $5 accruing 100 years ago can correspond in value to $100 today. (Notice that this is not only due to inflation. Typically, there is a positive (real) interest rate even without inflation). So, it *does* seem appropriate to value the same good vastly differently at different points in time even though this seemed implausible in the climate mitigation case. Can value be more or less valuable depending on time? The paradoxical language reveals that there is a conundrum.

This chapter joins the debate by tackling one central question and two minor ones. The central question is: Should we discount future utility, and if yes, how much? "The future" is in particular taken to stand for future generations. In order to answer the question two senses of discounting are distinguished: Genuine discounting ("Discounting as Weighting") and "non-genuine" discounting ("Discounting as Representing Opportunity Cost"). The former is discussed in section 2.2 and is dismissed. It is dismissed not only as wrong but primarily as irrelevant. The latter is discussed in section 2.3 and is supported.

Some texts on discounting deem it sufficient to make general points and leave the reader uncertain as to how the arguments cash out in terms of their implications for economic models of climate change. Therefore, section 2.4 summarises and discusses what section 2.2 and 2.3 amount to. One way in which this can be done is by answering two concrete questions that are examples of the kind of question to which one *must* have an answer at the end of the day (and which are useful to keep in mind while reading as questions of this kind ultimately drive the whole debate). First, should a climate mitigation measure that costs 5 units of utility today and increases utility by 100 hundred units in 100 years be pursued? Second, what is the total cost of emitting a ton of CO_2 if its emission leads to a utility loss of 1 unit per year for the next 100 years?

After the central question has been treated, sections 2.5 and 2.6 then add discussions of two minor issues. First, does the debate on discounting

treat a normative or a descriptive issue? Second, why does the discounting question have so much potential to puzzle and perplex?

A few disclaimers: First, this chapter is only concerned with the *utility* discount rate (also called the "pure time discount rate", the "rate of pure time preference", or the "inherent discount rate"). This rate tells us how to discount future utility rather than future wealth (or goods). For the latter, there are separate and often less controversial reasons for discounting, in particular the expectation that future generations will be richer and that they will therefore draw less utility from an additional unit of wealth than the presently living. Typical values for the utility discount rate lie between 0% and 3% per year (cf. the numbers used by Tol (2008, p. 3)). Second, "utility" here denotes well-being (or whatever it is that is of intrinsic value and of which it is good to have more). This is in alignment with cost-benefit analysis (of which climate economics is an example) where utility is typically seen as something that increases with wealth and possibly with other factors such as environmental quality. In decision theory, the term "utility" can refer to other and more abstract concepts (e.g. whatever it is that can be portrayed as being maximized in behaviour regardless of whether the maximand is of value or is considered to be of value by the agent). We only use it because in the discounting debate it is the more common term than "well-being". Third and importantly, we concede other controversial premises presupposed in cost-benefit analysis for the time being, particularly the premise that all values that enter the consequentialist calculus are commensurable, can be quantified and count only insofar as they contribute to utility. This means *inter alia* that climate damages affecting future generations can in principle be weighed up by other goods, such as economic growth. The reason for bracketing such controversial premises lies in the goal of this chapter, which is to argue on the economist's own terrain and to cut through to the debate that is *specific* to discounting. Fourth, the focus of this chapter lies on the question of discounting *utility of future generations* rather than *future utility within one's own lifetime*. To simplify, we

therefore assume non-overlapping generations. We also abstract from the fact that generations are composed of many persons and we thereby exclude questions of intragenerational distributive justice. Fifth, we exclude uncertainty. Finally, note that nothing in this chapter is specific to climate policy but applies more broadly to any policy that has effects spread out over time.

2.2 Genuine Discounting: Probably Wrong But Above All Unnecessary

Should we discount the utility that our descendants will enjoy simply because it occurs in the future? Presupposing impartiality, neutrality, universalisability, equality, non-arbitrariness, or any other similar moral desideratum, giving less weight to utility that accrues to future generations is at least *prima facie* implausible. This is particularly so for the theory within which the debate on discounting is at home: Utilitarianism. Economic cost-benefit analysis that has brought the discounting problem to attention espouses utilitarianism's ideal of maximizing the sum of good regardless to whom the good accrues. With this core idea utilitarianism has no resources to come up with a rationale for counting the consequences of a policy for some persons less than the consequences for other persons. This would imply foregoing the maximization of aggregate good (where aggregate good is the unweighted sum of the good accruing to individuals). Economists might insist that they define good in terms of *preference* satisfaction, and that what must be maximized is the aggregate preference satisfaction of the *present* generation, which is the one currently deciding on policies, and that the preferences of the present generation *do*, as a matter of fact, exhibit positive time preference. But this rejoinder solves no problems: Once one presuposses that aggregate preference satisfaction is something of importance there is no rationale why a concern with *aggregate* preference satisfaction should be limited to aggregating only the satisfaction of preferences of the subset of humans who live now and who decide on the policy. Given that a

positive discount rate is, to say the least, not suggestive at first sight (and given that, in addition, there are worked out arguments against it; see for example the contributions by Tyler Cowen and Derek Parfit in Fishkin and Laslett (1992)), the burden of proof lies with those who argue for a positive discount rate.

One such argument for a positive discount rate (though not the most important one) is the claim that a discount rate of zero leads to a *reductio ad absurdum*. Partha Dasgupta (2007, p. 6), for example, has shown how low discount rates would lead to savings rates that are implausibly high. Given Stern's low discount rate, one should demand a rate of savings of 97.5% of all output in an optimal growth model (compare this to the current savings rate in the UK of about 15% of GDP). The idea of optimal growth models is to look for a balance between consumption and savings that maximizes discounted utility over time, where it is assumed that what is saved is invested at a positive rate of return. Another *reductio* is based on the fact that humanity potentially exists forever (or for a very long time). Even the smallest gains to an infinitely large number of future humans might, given a discount rate of zero, justify even the largest possible sacrifice of the present generation. Demanding a savings rate of 97.5% or demanding the largest possible sacrifice from the present generation are both absurd conclusions, and if the discount rate of zero should actually have such implications, it surely would have to be dismissed immediately.

But scrutinizing whether it really is the premise of a discount rate of zero that leads to such a conclusion reveals something crucial. What these arguments *actually* point out is that *if* one aims at maximizing aggregate utility and *if*, for that purpose, one weights the utility of present and future utility equally (i.e. applies a discount rate of zero), *then* one runs into a *reductio ad absurdum* (cf. Caney (2008, p. 549)). But this *reductio* can not only be evaded by giving up a discount rate larger than zero, it can also be evaded by giving up the goal of maximizing aggregate utility. And this is the route we propose: We should not evaluate policies with effects

over more than one generation by their effect on aggregate utility. Simple utilitarianism is a theory with few proponents, in particular for judging issues like climate policy. It is amazing how economists actually *did* manage to persuade politicians to see the sum of utility over the next decades and centuries resulting from, say, the Kyoto Protocol as an important figure in the decision to support it or not. If one grants that this sum is not very relevant then the adequate response to the above *reductiones ad absurdum* becomes clear: The first conditional is to be rejected and not the second, i.e. the whole underlying theory of utilitarianism is to be rejected and not simply the discount rate of zero within utilitarianism. The latter is hardly the problem (as we did not argue but just briefly suggested in the first paragraph of this section).

What is an alternative to utilitarianism? It suffices here to sketch in a completely broad-brush manner the general thrust of a deontological alternative. Such an alternative makes a clear distinction between the effects of a policy that affect the present generation (who decides on the policy) and those effects that affect future generations. In contrast to utilitarianism, deontological morality treats the effects of an action completely differently depending on whether they fall on oneself or on others. Within the confines of the premises mentioned in the introduction to this chapter – i.e. that everything of value can be expressed in terms of utility – one plausible way of spelling out how a deontological alternative to utilitarianism takes future generations into account in present-day decision-making requires from the present generation to bequeath a certain threshold level of utility to future generations. A theory of intergenerational distributive justice (or a theory of sustainability) could specify this level in egalitarian terms (say, as much as the present generation enjoyed) or, more plausibly, in sufficientarian terms (say, enough to lead a decent or flourishing life) (cf. Meyer and Roser (2009)) and possibly speak of this level as a right of future generations. Such a threshold principle is at odds with the utilitarianism of cost-benefit analysis: If the present generation has set aside enough resources – in the

form of climate mitigation, capital formation, and so on – for the sake of future generations such that the latter can reach the required threshold of utility, the present generation need not concern itself with increasing future utility any further (though it may of course do so, for example because of beneficence or because of the warm glow of imagining one's descendants well off). If a policy would yield huge benefits to the future at low costs to the present, the present generation would have no duty to pursue it. Conversely, if the present generation has not set aside enough resources to lift future generations above the required threshold of utility, policies that yield only slight improvements to future generations can be required of the present generation even if the latter should thereby incur large costs.

As a side remark, note that, in general, this alternative is neither more lenient nor more demanding towards the present generation than utilitarianism. This is worth mentioning because there is sometimes a fear among defendants of a positive and high discount rate that their opponents might be environmentalist saints who want to place unrealistically stringent demands on the present generation in arguing against positive discount rates. Actually, the tables can be turned (cf. Caney (2008, p. 549)): Typically, in moral philosophy, consequentialism (of which the utilitarianism of cost-benefit analysis is a species) is seen as having the problem of being unduly demanding.

What discount rate does this deontological approach involve? The simple answer is: None at all, not even a rate of zero. For effects that concern future generations, it does not make a discount rate *necessary*. It thus rebuts the claim made by Pearce et al. (2003, p. 124) that "not discounting" amounts to "discounting at 0%". Discounting is *only* necessary if one weighs up present and future values. As soon as one weighs up values, one needs to accord weights to these values (with a zero discount rate amounting to according equal weights). The deontological approach, however, does not suggest giving "equal weight". Rather, it proposes not to weigh up the utility of present and future generations at all (and it therefore disagrees with

the claim by Anthoff et al. (2008, p. 3) that "any statement about the desirability of climate policy necessarily contains a value judgement about the importance of future gains *relative* to present sacrifices." (emphasis added)). Future generations' utility is something of which the present generation has to guarantee a certain amount of, regardless of whether the costs of doing so exceed the discounted benefits or not. And thus, in the intergenerational context and according to the deontological framework, the discount rate is *irrelevant.*

To reinforce the point, note that, in terms of counterintuitive implications, proponents of a low discount rate sit in the same boat as proponents of a high discount rate: If the uneasiness about a high discount rate stems from the fact that this makes even cataclysmal damages in the future count as trivial in today's terms, then one should be almost as uneasy about a low discount rate because the latter, too, evaluates cataclysmal damages as trivial in today's term as long as those damages happen just *far enough* in the future. This reveals again that the basic problem about discounting is the allowance of intergenerational trade-offs and not just the allowance of intergenerational trade-offs with the wrong weights. In principle, given the utility maximizing framework, even a zero or a negative discount rate makes it possible to justify the bequest of catastrophes on posterity.

To sum up this section: The diagnosis is that the whole discounting debate has gone off track. Those who care about justice being done to future generations have criticized economists for their high discount rates and have spent all their energy in arguing for lower discount rates or in investigating different kinds of sophisticated alternatives such as differential or hyperbolic discount rates. The correct point on which to attack the economic approach to climate change, however, is not the *magnitude* of the discount rate but rather the utilitarian *framework* – the framework within which the necessity of determining a discount rate springs up at all. Note that a point in this general direction – i.e. that many concerns about the discount rate would more aptly be captured by criticizing more fundamental

features of the economic approach than by criticizing the magnitude of the discount rate – has been made in some form or other by various authors, including prominent ones like Rawls (1971, pp. 297–98), Parfit and Cowen (1992, p. 149), Sunstein and Weisbach (2008, p. 7), and Nordhaus (1997, p. 327). It was succinctly expressed by Ferejohn and Page (1978, p. 274):

> Our result suggests that the research for a "fair" rate of discount is a vain one. Instead of searching for the "right" number, "the" social rate of discount, we must look to broader principles of social choice to incorporate ideas of intertemporal equity.

In terms of a disclaimer, it must be admitted that in this section the contrast between utilitarianism and its deontological counterpart was made very stark. In a more complete argument one would have to take into account that also non-utilitarian theories allow or prescribe weighing up *some* goods (and possibly even prescribe weighing up rights). And as soon as weighing up is allowed the question of the discount rate reappears. It reappears in particular when it comes to weighing up utility coming at different points within the present generation's own lifespan (this is morally much less problematic, however, than weighing up goods accruing to different generations).

2.3 The Opportunity Cost Argument

The conclusion of the last section, however, is not the end of the story as concerns the discount rate. Even if the above reasoning about the irrelevance of the discount rate is correct, discounting – or, more precisely, something that on the surface looks a lot *like* genuine discounting – still has a legitimate role to play.

We will distinguish two senses of "discounting" and label the genuine sense of discounting – discussed in the last section – "Discounting as Weighting".

The discount rate in this sense gives *weights* to utility at different points in time and values utility according to these weights. "Discounting as Weighting" is done with the purpose of aggregating utility at different points in time into a single number. The idea of the utilitarian moral theory that makes such a discount rate necessary is to choose the policy that yields the highest aggregate discounted utility: *How much* utility the present generation bequeaths to posterity is determined by whatever yields the largest sum of discounted utility. And since this sum depends on what discount rate is used, the discount rate is also a determinant of *how much* the present generation should invest for the sake of posterity. If a low discount rate is chosen, the present generation will have to forego much utility in order to invest for the future. If a high discount rate is chosen – and future utility thus counts for little in the maximization exercise – the present generation must set aside few resources for future generations.

In this section, another sense of "discounting" that we label "Discounting as Representing Opportunity Costs" will be discussed ("Opportunity Cost" is a concept from economics that is defined as the "cost" of foregoing the best alternative to an option one has chosen).

The quotation marks are supposed to indicate that this is not a genuine kind of discounting. "Discounting as Representing Opportunity Costs" is not done with the purpose of determining how much utility the present generation ought to leave behind for posterity, but rather (given the level it ought to leave behind) with the purpose of determining *by what means* utility should be transferred into the future, i.e., whether through investments into climate mitigation, or through investments into other projects such as infrastructure, poverty reduction, basic research, etc. All of these different projects exhibit a certain rate of return. Those projects with a high rate of return allow the present generation to set aside fewer resources to fulfil its duties towards posterity (in terms of guaranteeing a certain utility level) than those projects with a low rate of return. If it is the policymaker's goal to fulfil the duty at the lowest possible cost, determining what return on

investment the different projects have must be investigated. If climate mitigation has a lower rate of return than its alternatives, it is not the optimal project of choice for carrying out one's duty towards future generations.

In order to determine whether climate mitigation actually is a project with a lower return than other projects, the policymaker – or the economist advising him – can perform a mathematical exercise that on the surface looks exactly like genuine discounting: Assume that a certain climate mitigation measure costs 5 units today and prevents damages in the magnitude of 100 units in 100 years. One can then look at the most efficient alternative opportunity for which one could use the 5 units today and determine the rate of return this alternative investment opportunity has (call the latter rate of return i). In practice, the return that one can reach on alternative investments will be derived from the market interest rate (take $i = 4\%$ as an example; note that we are concerned here with a utility interest rate, while the observable market interest rate is of course in monetary terms). One can then "discount" future climate damages of the magnitude of 100 by the rate of $i = 4\%$, and if the discounted damage is smaller than the 5 units necessary to prevent this climate damage, the climate investment is inefficient and the same amount of utility for future generations could be achieved in a way that is cheaper for the present generation, namely by investing into the project that yields return i. In the current example, discounting 100 units occurring in 100 years with a rate of 4% would yield a value of less than 2 units and therefore be much smaller than the costs of the climate mitigation investment. This means that if the 5 units were instead invested at the market rate of return, they would yield a pay-off of more than 270 units in 100 years, which would count as a much more profitable investment than the prevention of climate damages. This is all just a roundabout way of making a basic point that is familiar to any business decision: The internal rate of return of a project – such as climate mitigation – should exceed a hurdle rate that reflects the cost of capital. Of course, on a less simplistic view a host of technicalities such as irreversibilities, uncertainties, etc. would

enter, but the foundational point remains that in general the capital used for a project should yield a higher return than its alternative use in order for the project to be worthwhile.

Presupposing the economic premise of substitutability between different goods, these kinds of efficiency calculations seem to be a legitimate consideration in judging climate policy. And, these kinds of calculations of opportunity costs can formally be represented as a discounting operation. However, in this kind of "discounting" operation no weighting of utility is involved at all. "Discounting" is only used as a mathematical tool of taking opportunity cost into account. One could make the whole argument without the notion of "discounting" and only rely on the notion of return on investment. This kind of discounting is neutral with respect to the foundational theory one employs – utilitarian or deontological – and with respect to how much utility one ought to bequeath to future generations. This kind of "non-genuine" discounting is only based on the idea that it is not a sufficient reason for engaging in climate mitigation that one owes something to posterity and that it is neither a sufficient reason that such mitigation investments have a positive return. Rather, since the resources that are put into climate mitigation are not available for other investments, and since these other investments typically have a positive return, too (and possibly an even larger one), climate mitigation investments can be said to have an opportunity cost. And if one is interested in fulfilling one's duty towards future generation at the smallest possible cost, this must be taken into account.

The fact that alternatives to climate mitigation yield large returns when compounded over decades, too, is something that, in our opinion, is not sufficiently taken notice of outside the discipline of economics. Many criticisms of discounting by moral philosophers or environmentalists are based on the *intuitive repugnance* of discounting: How could it be – so the critics ask, based on common sense – that the amount of resources deemed worthy of investing in the prevention of climate damages depends so dramatically on

the point of time when these damages materialise? How could it possibly be justifiable that this amount is, say, twenty times smaller if the damages materialise in 100 years rather than today? The opportunity cost argument reveals that this is not at all as repugnant as it seems at first sight. In particular, justifying discounting in this non-genuine sense does *not* have to be based on the – indeed morally repugnant or at least questionable – premise of considering future humans less valuable or giving less weight to the utility they enjoy.

A question remains, even if it is conceded that "Discounting as Representing Opportunity Costs" is justified: Is the justifiability of this non-genuine kind of discounting *really* independent from the justifiability of the genuine kind of discounting? It is – but confusion creeps in because there still is an indirect but harmless way in which opportunity costs depend on people exhibiting pure time preference, i.e. on people genuinely underweighting future utility. The opportunity cost of capital that is invested into climate mitigation can roughly be derived from the market interest rate. The market interest rate depends on a number of factors. Some of these factors are not influenced by humans, but others are: If people exhibit a high rate of pure time preference, i.e. if they discount future benefits and costs heavily, this is equivalent to a low demand for future goods, which in turn drives interest rates upwards. So, if people actually *are* impatient (a descriptive claim), this can drive up opportunity costs and therefore indirectly make climate mitigation less recommendable (a normative claim). The important point to note here is that the legitimacy of taking opportunity costs into account when deciding on climate policy does not depend on the moral evaluation of the determinants of the magnitude of these opportunity costs. The market interest rate that determines the magnitude of opportunity costs might be high due to selfish and irrational behaviour – which is a description some would want to give to behaviour driven by pure time preference larger than zero – but this does not affect the sheer fact that climate investments *do* have an opportunity cost of that magnitude (cf. Birnbacher (2003, p. 50)).

In the language of economic theory, the point can be expressed as follows: What Marginal Rate of Substitution (MRS) between present and future units people's preferences exhibit – i.e. how they value present compared to future units – is not *directly* relevant to the discounting question, or, more precisely, not relevant for the discounting question in the *intergenerational case*. In the intergenerational context, the only factor that is directly relevant is the Marginal Rate of Transformation (MRT) between present and future units. The MRT expresses the relative price of present units compared to future units. It is another way of expressing the rate of return. In a market economy, however, the MRT is not independent of the MRS – in equilibrium, they are even equal – and so people's *actual* future-regarding preferences do affect, in an indirect way, how we *ought* to evaluate future-regarding policies. How we ought to evaluate future-regarding policies depends on the MRT, and if the MRT is dependent or even equal to the MRS this can of course mislead one to take the MRS as the basis for discounting. This mistake is, for example, committed when some authors, based on a respect for democracy, *prescribe* a positive discount rate directly on the basis of people's *actual* underweighting of future utility, or when they prescribe a hyperbolic discount rate directly on the basis of the empirical fact that people actually exhibit hyperbolic preferences. The primary thing to do, however, is to note that these attitudes of people affect the rate of return of capital and therefore the opportunity costs of climate mitigation – and then to focus on the opportunity costs as the consideration that is directly relevant.

Recall that the argument for the legitimacy of non-genuine discounting rests on the premise mentioned in the introduction, namely that all values can be bundled together in one overarching value (utility), and that therefore any kind of investment counts as substitutable for another as long as it yields the same amount of utility as the other. Many people – both philosophers and non-philosophers – are critical of this premise. If one should, for example, think that a dollar invested in medical research or economic

growth has a much higher return than a dollar invested in climate mitigation or conservation of biodiversity, but if one should *also* think that medical progress and economic growth should not be substituted for climatic stability and biodiversity, then the opportunity cost argument for preferring investments into medical research and economic growth over climate mitigation and biodiversity conservation loses all its power. The opportunity cost argument loses all its power, *a fortiori*, if one believes that these different goods are not even commensurable or that there is something deeply wrong about conceiving of them as "investments" and that it therefore does not make sense to speak about comparing their returns.

2.4 Implications

What answers do sections 2.2 and 2.3 give to the original question "Should we discount future utility and if yes, how much?" The answer depends on what sense of "discounting" is involved and what one uses the discount rate for.

Discounting in the first sense (cf. section 2.2) is understood in the sense of weighting, and it is used for the purpose of judging policies by the sum of weighted utility they bring forth. The appropriate response to this kind of discounting is to question the goal of maximizing a sum of weighted utility in the first place, and not only to question how utility at different points in time is weighted. When policies are judged by this maximization criterion, not only are the *means* to benefit future generations judged by their effects on aggregate utility, but also the *distribution* of utility among generations. This is problematic: How much utility the present generation ought to leave to future generations should be determined by defining a certain level of utility owed to future generations independently of aggregate considerations, but rather based on deontological reasoning.

Once one has determined *how much* the present generation should bequeath to posterity, one then has to determine *by what means* the present

generation should bequeath this amount of utility. To answer this question, a discount rate may legitimately be used. A discount rate in this sense represents opportunity costs (cf. section 2.3). Using such a discount rate – and deriving it from the market interest rate – allows to account for opportunity costs of climate investments in a mathematically elegant way (even though it could also formally be done without a discount rate). It is nothing more than an instrument to compare the returns of different sorts of investments.

In summary, the conclusion is that – at least in the intergenerational context and given the premise of the legitimacy and possibility of substituting different investments for each other – genuine discounting in the sense of according weights is not necessary, and non-genuine discounting in the sense of representing opportunity cost is justified.

How does this conclusion deal with the two concrete questions mentioned in the introduction? The first question is: Should a climate mitigation measure be pursued that costs 5 units of utility today and increases utility in 100 years by 100 units? In one scenario, assume that discounting these 100 units by the rate of return of the best available alternative investment yields a value of 6 units. In other words, the rate of return on climate investments is 3% and the rate of return on the best available alternative investments is 2.8%. Should the climate mitigation measure be pursued? Not necessarily. Whether it should be pursued not only depends on its being more efficient than alternative projects, but also on whether the measure is necessary to lift future generations above the threshold level of utility required by considerations of intergenerational justice. If the present generation has already set aside enough for posterity, then there is no binding reason to pursue climate mitigation even if mitigation has a positive net present value. In another scenario, assume that discounting the 100 units of prevented damage by the rate of return of the best alternative investment yields a value of 4 units. In other words, the rate of return on the best available alternative investment in this scenario is 3.2%. Should the climate measure be pursued in this case? If the policymaker cares about achieving an intergenerationally

just policy at the lowest possible cost, the answer is no: If the present generation owes further utility to future generations, this utility could be "bought" at a cheaper price if one engaged in the alternative investment rather than by protecting the climate. This is what discounting (in the sense of "Discounting as Representing Opportunity Costs") reveals.

To sum up: The fact that discounted future benefits (where the discount rate is determined by the return on alternative investments) exceed the present costs of a given climate policy is a necessary but not a sufficient condition for the policy to be recommendable. This is in contrast to the typical cost-benefit analyst who would regard it as both a necessary and sufficient condition.

The second question is: What is the total cost of emitting a ton of CO_2 if its emission leads to a utility loss of 1 unit per year for the next 100 years? The answer to this question is less clear than is generally recognized by proponents of discounting. One interpretation of the question is this: How much would it cost us today to make investments that make everybody as well off as if the ton of CO_2 had not been emitted? In order to answer this question, the reasoning concerned with non-genuine discounting is relevant: The damage done in the future must be discounted by the rate of return on alternative investments that are necessary to counterbalance the utility loss generated by the emission of CO_2. On this interpretation, the total cost of emitting a ton of CO_2 is much less than 100.

A second interpretation, however, takes the question at face value and simply asks what the costs *are* (regardless of how they could be counterbalanced). The answer to this question corresponds to the reasoning concerning genuine discounting. If one wants to know the total costs – *simpliciter* – there is no reason to discount future costs before adding them up. The total costs are 100 units and nothing less (even though the costs for counterbalancing these costs of 100 are much less than 100). There is a difficulty with this second interpretation of the question, however: Why should one be interested in the answer to such a question in the first place? In what way

are the costs caused by a ton of CO_2, aggregated over generations, relevant to the decision of the present generation on how much CO_2 to emit? For the present generation, what matters primarily are two points: first, that justice is done to future generations and, second, that justice is done at the lowest possible cost to itself. Total costs show up in neither of these two considerations.

How could these conclusions from section 2.2 and 2.3 be incorporated into the actual models built by climate economists? Cost-benefit analysis that aims at maximizing net present value does not yield answers to questions we are interested in because picking a policy which results in the maximal sum of utility across generations is not what we ought to care about (and it is neither what most people actually do care about). Neither is the Social Cost of Carbon computed for many decades a number that contains decision-relevant information. Something closely related to classical cost-benefit analysis, however, produces relevant results, namely cost-effectiveness studies (or, similar approaches such as the tolerable windows approach). In such studies that separate the equity and the efficiency question a certain target is defined, say, an emission concentration or a temperature threshold (both could be interpreted as a proxy for the utility level owed to future generations), and then the most efficient path – taking into account opportunity costs – to reach that target is calculated. Such an approach makes future utility independent of cost-benefit considerations and therefore also independent of discounting debates.

2.5 Normative or Descriptive

The literature on discounting is not unanimous about the *status* of the debate: Is there a disagreement on a normative or on a descriptive issue? Some claim that there is something deeply irritating about descriptivists (cf. Birnbacher (2003, p. 47)), while others deride those calling for moral argument as arrogant (cf. Nordhaus (2007, p. 691)). Still others speak of

there being both a descriptive *and* a prescriptive approach alongside each other (cf. Arrow et al. (1996)). The crucial question is this: Does one have to invoke not *only* descriptive premises but *also* normative premises in arguing for the correct view on discounting?

In some very limited sense, one need not invoke normative premises to choose a discount rate: Anyone can run economic models of climate change and one can do so for whatever purpose one likes. If that purpose is just the fun of doing maths or to see what happens when plugging in different numbers for the discount rate, then the choice of a discount rate obviously is not a normative matter.

However, economic models of climate change are typically built with a certain *purpose* in mind. This purpose consists in helping policymakers decide on what should be done. "What should be done" – this is an irreducibly normative matter. How, then, does the normativity of the purpose of the economic model "infect" the choice of the discount rate with normativity? Economists know that they can neither make a unique model for every single person that would like to have judged climate policy according to his own preferred criteria (including the discount rate), nor can they explain to policymakers in depth and detail the criteria (including the discount rate) according to which economic models evaluate climate policy. In such circumstances, and when forced to decide on which criteria to use when putting a yardstick to climate policy, using those criteria that would democratically be chosen seems to be a sensible way to go. And this is how climate economists often defend the discount rate they use: They claim to use the discount rate that people would actually plug into their models if they could do so. Where do they get the information about people's views on the discount rate? They claim that the *market interest rate* mirrors the preferences of people concerning discounting and is therefore democratically justified. Many will also claim that *reading off* the discount rate from the market interest rate makes the choice of a discount rate a descriptive issue rather than a normative issue.

In response to these claims, we have two remarks: First, even if the observed market interest rate should figure somewhere in the premises of the argument for the correct discount rate to be used, this does not by itself make the choice of the discount rate a purely descriptive issue. There are other premises left, and at least one of them is a normative one: The premise that in economic modelling one *should* use those criteria – such as the magnitude of the discount rate – that people would democratically approve of. Even if this premiss about democracy is not a very controversial premiss, it still is a normative premise. It is a premise relating to the professional ethics of modellers who know that policymakers listen to them without being able to completely understand their models. Second, we go along with the idea that economic policy advice should work with the criteria that people would democratically approve of. But we find it extremely implausible to claim that one can read off how presently living people would like to treat people living in the future from market interest rates. This assumes that presently living people not only maximize discounted utility over their own lifetime but that this maximizing framework is also what they would like to apply to the utility of future generations. A much more reliable way of finding out how people want to incorporate the effects of policies on future generation's utility in their action guiding principles is to start reflecting on how one would do that oneself, to discuss the results with moral philosophers, social scientists, and psychologists and, most importantly (though most expensively) to engage in surveys.

So far we have argued the following in this section: For the economist who is involved in modelling, the choice of the discount rate *is* normative but it is *only* normative in the very limited sense of presupposing the normative premise that one should use those criteria that the democratic body would approve of. Once he has decided on this normative premise, he is then only involved in the *descriptive* issue of finding out what the democratic body thinks about discounting.

But matters are different for the democratic body itself. For the democratic body, the discount rate is a more substantively normative issue. If people have to decide on how future generations *ought* to be treated, normativity can in no way be stripped off from this "ought". They cannot rely on what the democratic body thinks because they *are* the democratic body itself. Depending on how people want future generations to be treated, they have to tell their scientists what kind of numbers to calculate: Either numbers that inform them about the sum of discounted utility of various policies (and if so, with how high a discount rate), or numbers that portray the costs of different policies that all bequeath a certain pre-defined level of utility to future generations, or still other numbers that are only relevant when one is interested in laying still another normative yardstick to policy. It is of course granted that once these normative questions on how future generations' utility ought to be taken into account are decided, there still remain a host of descriptive issues to be looked at, not the least of which is the use of the market interest rate as a proxy for the opportunity cost of capital.

2.6 The Roots of Confusion

The debate on discounting has brought forth a lot of puzzlement and perplexity. This can be traced to at least three features of the issue.

First, since discounting is concerned with future generations, it is concerned with justice among an indefinite and potentially infinite number of individuals. Neither our theories of justice nor our human thinking, more generally, is adapted to deal with infinity. Our minds are already bad at handling very large numbers and infinity is something completely different still. Since the underlying utilitarianism involved in cost-benefit analysis is interested in maximizing the sum of individuals' utility up into the indefinite or infinite future, our human inability to grasp and deal with such concepts should not be taken lightly.

Second, real people actually *do* discount within their *own* lifetime: They aim at increasing the sum of utility over time, but give less weight to utility when it accrues in the future than when it accrues in the present. This empirical fact poses a difficult problem for the discounting debate on intergenerationally relevant policy choices. First, it is a difficult question whether such discounting in personal choices within one's own lifetime should be thought of as irrational (after all, utility that we receive in the future is just as much utility as when we receive it in the present) or whether it should simply be seen as a matter of taste to prefer utility in the present to utility in the future (after all, what is so different about preferring apples over oranges to preferring utility today over utility tomorrow?). A particularly strong, though not conclusive, case can be made that hyperbolic discounting must count as irrational since it leads to time inconsistency. Second, it is unclear in what way considering discounting within one's own lifetime to be legitimate should affect how one views the legitimacy of discounting in policies with effects beyond one's own lifetime. This is particularly so because, whereas for each individual there is a clear distinction between its own lifetime and people living or being born after its lifetime, for society (the "present generation") as a whole (and it is society as a whole that decides on policies) there is no such distinction.

Third, there is something deeply "magical" about the fact that investments have a positive rate of return (or worded differently: that "capital is productive" (Gosseries (2008, p. 66)) or that "technology is fertile" (Broome (1994, p. 139))). This familiar and obvious fact is the most unrecognized but most powerful cause of puzzlement inherent in the discounting debate. If we plant one apple today an apple tree will grow and we will have more than one apple in the future. Apples *increase* over time. As a consequence of this, it becomes a genuinely philosophical issue whether two apples today should be seen as equally valuable as two apples in the future. Even though we are talking about the *same* amount of the *same* good (only at different points in time), two apples today are in some sense *more* valuable than two

apples in the future. The reason is that if one owns the two apples today, rather than in the future, one can plant one of the two apples and eat the other and therefore have more apples both today (one apple instead of zero) *and* in the future (say, three apples instead of two) than if one had the two apples only in the future. The paradox in the claim that two apples can be more valuable than two apples is rooted in the fact that this claim, as used in ordinary talk, does not specify whether the two apples in question are consumed or owned. Consuming two apples is indeed equally valuable today and tomorrow. Owning two apples is not – due to the possibility of "investing" them profitably. The same holds true not only for apples but for many investments, and also indirectly for utility. Foregoing utility today implies the ability to harvest more utility in the future than the amount foregone today. That is the opposite of a leaky bucket, it is an "incubation bucket", so to speak (cf. Schelling (1995, p. 398)). And our theories of distributive justice have not, in general, dealt with the issue of values that increase when being "redistributed", and in particular not with the potential – given the open future – to increase indefinitely (for an interesting exception, see Moeller (2006)).

These three factors taken together, and in particular the last one, explain some of the difficulty in coming to terms with the discount rate.

3 Rights-Sensitivity and Risk-Aversion

3.1 Introduction

This chapter discusses the link between rights and risk-aversion. The risk-aversion of a rights-sensitive decision-maker is based not only on the concavity of the utility function but also on how the utilities of other agents enter his choice problem. Compared to a utilitarian decision-maker he thus has additional reasons for risk-aversion.

The link between rights and risk-aversion is especially relevant for topics such as climate policy. In the climate policy arena there is a loud and persistent voice which demands risk-aversion beyond the justifications of standard economics. This voice – manifesting itself in calls for the application of a precautionary principle – has not often made its case in precise and coherent terms. But since the vague intuition on which it is based ("better safe than sorry") is very powerful, it is worthwhile to seek ways of making its message clearer and giving it a sounder rationale than it has been given so far. We claim that replacing the utilitarianism of standard economics by a rights-sensitive approach to policy choice yields such a rationale.

In order to support this claim, we propose three stylized ways of capturing the logic of rights within a formal model. All three alternative versions reveal the basic reason why rights imply risk-aversion: Violating a right constitutes a large downside risk while "overfulfilling" a right constitutes no comparable upside risk. This asymmetry is responsible for the kind of risk-aversion incorporated in rights-sensitive but not in standard economic models.

In the background of this chapter is the fact that climate policy has given new prominence to questions of intertemporal distribution. Engaging in such policies as emission reductions is costly for the present generation but benefits mainly future generations. What criterion should be used to judge policies which affect the intertemporal distribution of costs and benefits? In addition to the issue of intertemporal distribution, climate policy has also given new importance to the issue of uncertainty. There is large scientific uncertainty about the long-term effects of our current climate policies. Continuing with the current level of emissions might bequeath anything from small costs to catastrophic harm to our descendants. In what manner should the extent of uncertainty affect policy choice?

Climate economics and its underlying utilitarianism have a standard way of dealing both with the issue of intertemporal distribution and with the issue of uncertainty. The intertemporal distribution resulting from a given policy is evaluated in terms of efficiency, i.e. in terms of whether it increases "the size of the pie". The uncertain effects associated with a given policy are evaluated in terms of their *expected* utility. Both, this approach to intertemporal distribution and this approach to uncertainty, are faced with criticism. Many claim that intertemporal distribution should not only be judged in terms of efficiency but also in terms of equity, i.e. in terms of how "the pie is split up". In particular, since distribution across time concerns not only future points of time within our own life but affects also our descendants, rights of future generations to a certain slice of the pie should be taken into account. The approach to uncertainty is criticized for downplaying the relevance of uncertainty.[9]

[9] Various authors on the precautionary principle choose economic theory (or slightly broader or narrower theories such as expected utility theory or cost-benefit analysis) as the benchmark compared to which a precautionary principle demands something different (cf. Sandin (2004, p. 6); Gardiner (2006a, p. 35); Sunstein (2005, p. 351). In terms of an interesting contrast to this literature, the Stern Review (2007, p. 38) already conceives of classical risk aversion as representing a (narrow) precautionary principle). Note that there are also many attempts *within* a standard economic framework which aim at incorporating our intuitive sense that the uncertainty associated with climate change may be more relevant than it seems at first sight. Prime

This chapter claims that there is a link between these two criticisms of the standard economic approach: Evaluating intertemporal distributions not only in terms of the sum of utility but also in terms of whether rights of future generations are fulfilled yields a particular reason for risk-aversion. If one finds fault with simply adding up utility across points of time (weighted by a discount factor) one also has a reason to find fault with simply adding up utility across states of nature (weighted by their respective probability).

In a nutshell, the basic idea why a concern with rights is linked to risk-aversion is the following. Rights involve a threshold – a reference point – below which they are violated and above which they are overfulfilled. The logic of rights involves a resistance to trade off a probability of violating a right with a probability of overfulfilling a right. In other words: A right to x is not in general fulfilled by the expectation of x. Even a large probability of bequeathing more to our descendants than we owe them can often not make up for a small probability of bequeathing less than we owe them. In an uncertain context, the central concern for rights thinking is therefore not the average outcome but rather the avoidance of the downside risk of violating rights. This asymmetry inherent to rights is responsible for risk-aversion.

The chapter is structured as follows. Sections 3.2 and 3.3 are concerned with the preliminary task of capturing rights in a formal model. Section 3.2 introduces the outline of the model. Section 3.3 first portrays the utilitarian decision-maker of standard economics as a benchmark. Second, after a subsection on the logic of rights – which is more philosophical in outlook and which can be skipped by readers not interested in this foundation – three alternative versions of modelling the choice problem of a rights-sensitive decision-maker are presented. Section 3.4 is concerned with the task of proving and discussing how a rights-sensitive decision-maker (on any of the three versions from section 3.3) is risk-averse and is so on additional grounds compared to a utilitarian decision-maker. Section 3.5 concludes.

examples are Weitzman (2009), Gollier and Treich (2003), or Kuntz-Duriseti (2004); see also Tol (2003).

3.2 The Model

We will work with the following model: There are two generations $i = 1, 2$ representing the present and the (non-overlapping) future generation. Utility U_i of generation i represents i's wellbeing and depends on its consumption c_i. Consumption is to be understood broadly enough to include anything which yields wellbeing. The utility function U is assumed to be the same for both generations: $U_i = U(c_i)$. Consumption c_2 of the future generation is a random variable distributed according to a cumulative distribution function F_2. The expectation of a given F_2 is μ_2. The variance, which represents the extent of uncertainty about future consumption, is σ_2^2. Consumption c_1 of the present generation is assumed to be non-random. The future and the present generation generation are both assumed to have a right to a utility level of at least $\overline{U}$. The consumption which corresponds to $\overline{U}$ in a state of certainty (i.e. $\sigma_2^2 = 0$) is denoted by $\overline{c}$. We assume that there is always at least one feasible combination (c_1, F_2) in the choice set for which it is true that $U(c_1) \geq \overline{U}$ and $E[U(c_2)] \geq \overline{U}$. This is the only assumption we make about the set of feasible combinations of (c_1, F_2). The present generation is the decision-maker who must decide on the policy which will affect both generations. It must choose one element from the the choice set of feasible combinations (c_1, F_2). It does so by solving a choice problem which has $U(c_1)$ and $U(c_2)$ as its arguments.

The idea behind this setup is the following. When the present generation chooses a particular probability distribution over future consumption, F_2, along with a certain level of present consumption, c_1, it faces a trade-off between the levels of c_1, μ_2 and σ_2^2. The trade-off between c_1 and μ_2 can be seen as exemplifying the classical consumption-savings-decision. Saving little means bequeathing little to the future, consuming little means bequeathing much to the future. Investments – into climate policy but also more traditional investments – for the sake of increasing the expected consumption of future generations is no free lunch for the present generation.

The trade-off between μ_2 and σ_2^2 can be seen as exemplifying the choice between different types of investments for the sake of future generations. Given a certain c_1, some investments bequeath a comparatively low σ_2^2 and a comparatively low μ_2 to future generations while other investments bequeath a comparatively high σ_2^2 and a comparatively high μ_2. In the present context the following example is particularly salient. Investments into radical mitigation policies yield a low σ_2^2 for future generations. However, this reduction in uncertainty delivered by mitigation policies comes at a price. If the money used for radical mitigation policies were instead employed for investments into alternative policies – say, strategies which put more weight on adaptation, economic growth and poverty reduction – this would yield a somewhat higher μ_2 for future generations but it would do so at the expense of a higher σ_2^2. The purpose of this chapter is to examine the particular reasons a rights-sensitive decision-maker has for keeping σ_2^2 low.

3.2.1 A Note on Utility

In the literature, the term "utility" is sometimes used for representing the wellbeing of an agent. At other times, it is used for representing the maximand of an agent. It is important, however, not to conflate these two meanings.[10] One should not assume *a priori* that agents must maximize

[10] The latter interpretation – utility as the maximand – is the more official interpretation in decision theory and economics. The former interpretation – utility as wellbeing –, however, is omnipresent, too, particularly in informal talk as well as in the field of applied economics where utility is often modelled as a function of only such factors as can be assumed to affect wellbeing (such as wealth, climate damages, etc.). In experimental economics, the former interpretation (in a slightly narrower meaning than presented here) also goes under the heading of "experienced utility" while the latter interpretation goes under the heading of "decision utility" (see Kahneman (2000, p. 673)). The gap between the two interpretations of "utility" is also revealed in the introduction of the terminology of "instantaneous utility" (or "felicity"). Instantaneous utility stands for utility at a particular point in time. If utility (or social welfare) as a *weighted* sum of instantaneous utilities is to be maximized, then the unqualified use of utility in the first part of the sentence represents the interpretation of utility as the quantity to be maximized while the use of utility in "instantaneous utilities" obviously does not represent an intepretation of utility as a quantity to be maximized (otherwise instantaneous utility would not be weighted by discount factors).

their wellbeing. Even if wellbeing is understood in line with the broadest (but still substantive) sense of the term, i.e. in the sense of what it is for a life to go well for an agent, the wellbeing of an agent and the maximand of an agent can diverge. The analogous holds true for the notion of "social welfare": Here, too, we must not assume *a priori* that the aggregate wellbeing of society (social welfare) must coincide with the function that a decision-maker in the role of a policy-maker must maximize.

In order to keep the two meanings apart for this chapter, we declare that we understand the utility of an agent strictly in the sense of his wellbeing and social welfare as the sum of individual wellbeing. The maximand of a decision-maker will figure in this chapter as an element of his "choice problem". The notion of a choice problem has the advantage of being a broader and less ambiguous concept than a utility function or social welfare function.

3.3 Rights-Sensitive Decision-Makers

In this section, we describe the choice problem which a rights-sensitive decision-maker solves. But first, in terms of the contrasting benchmark, we present the choice problem which the utilitarian decision-maker solves and which is often espoused by standard economics for such purposes as evaluating climate policy.[11] Utilitarianism maximizes aggregate expected utility:

$$\max_{c_1, F_2} (U_1 + E[U_2])$$

subject to the technological constraint that the chosen (c_1, F_2) is in the

[11] One could equally well contrast rights thinking to similar but slightly broader or narrower theories than utilitarianism which go under such labels as consequentialism, expected utility theory, traditional decision theory, cost-benefit analysis, etc. Rights thinking, too, could be portrayed as being equivalent to, close to or part of such theories as deontological, duty-based and Kantian ethics, liberalism and libertarianism, theories of justice, or decision-making with sacred or protected values.

choice set (we will henceforth presuppose this technological constraint without mention). For simplicity's sake, we assume a discount rate of zero (we discuss discounting in section 3.4.3). Such a decision-maker exhibits risk-aversion with respect to c_2 whenever the utility function is strictly concave.

The contrasting perspective of rights-sensitive policy choice will be characterized, first, verbally and philosophically in section 3.3.1 and, second, more formally in section 3.3.2.

3.3.1 The Logic of Rights

For the purpose of this chapter, we define a rights-sensitive decision-maker in a minimal sense: Any decision-maker counts as rights-sensitive who solves a choice problem which evaluates the protection of rights favourably and which does so independently of any instrumental value of rights. This minimal characterization already excludes utilitarianism from genuine rights thinking. The following five (and partly overlapping) aspects characterize the logic of rights a bit further. In the very general form in which these features outline rights thinking most people are rights-sensitive to some degree.

Separateness of Persons. Utilitarianism envisages society, metaphorically speaking, as a large "super-person" whose utility ought to be maximized whereas rights thinking can be characterized as taking the "separateness of persons" seriously.[12] Individual agents may legitimately be concerned with their own affairs in their choices rather than giving society as a whole the same consideration. This sphere of legitimate prioritization of their own concerns has strict limits, however, in that individuals must respect the rights of all other individuals. In an agent's choice problem,

[12] See Rawls (1971, p. 27). Note that in this chapter the contrast between single agents or decision-makers on the one hand and society as whole on the other hand is exemplified by the contrast between a single generation and both generations taken together.

therefore, the maximization of aggregate utility can be trumped by the priority of both, the agent's own concerns and the rights of others.[13]

Agent-Relativity. According to utilitarianism, every agent ought to solve the same choice problem and every agent enters this common choice problem in the same way. Rights thinking, in contrast, employs an agent-relative choice problem into which the concerns of others enter in a different manner than the agent's own concerns.

Non-Consequentialism. Utilitarianism advises choosing whatever has the best consequences. Rights thinking disagrees with this ideal and the way it disagrees can be captured in two different ways. According to the *first* (and more traditional) conceptualization of rights thinking, something can speak for or against a choice independently of its consequences, namely whether the chosen act constitutes a rights violation or not. According to the *second* (and less traditional) conceptualization, the protection of rights is itself seen as a type of good consequence. In contrast to utilitarianism, however, agents ought not necessarily to aim at the *best* consequences if best is understood in an agent-neutral sense. If we assume, for example, that an agent has stronger reason not to commit a rights violation himself than to prevent the same rights violation committed by somebody else then we admit that rights violations, understood as consequences, do not enter an agent's choice problem in proportion to their (agent-neutral) value. For a detailed treatment of these issues, see Sen (1982).

Resistance to Trade-Offs. Utilitarianism allows trade-offs between any two goods of equal value. Rights thinking, in contrast, exhibits a certain resistance to trade-offs. In the extreme, it exhibits an absolute prohibition of certain trade-offs, i.e. it prioritizes the fulfillment of rights to such a degree that no value could weigh up a rights violation. Rights can thus be

[13] The latter feature also distinguishes rights thinking from egoism. While both, rights thinking and egoism, do not demand from agents to take up the perspective of an impersonal social planner, it is only the former which sets certain bounds – grounded in the concerns of other agents – to the maximization of an agent's own utility.

seen as "sacred values" or "protected values" (cf. Baron and Spranca (1997) or Tanner et al. (2007)).

Thresholds. Utilitarianism's choice problem is a smooth function of the utilities that enter into it. Rights thinking, in contrast, involves thresholds (cf. for example Caney (2009)). Up to the threshold where rights are fulfilled, an agent must give precedence to the concerns of others. Beyond that threshold, the concerns of others do not have to take on much importance for an agent. Agents can take a "satisficing" approach towards the concerns of others, so to speak.

One should not be misled to distinguish rights thinking from utilitarianism by holding the former to be more demanding, for example by assuming that in the intergenerational context a rights respecting policy objective necessarily places greater burdens on the present generation than a utilitarian approach (cf. Caney (2008, p. 549)). One should neither conflate respect for rights with other motives for taking the concerns of others into account. In the literature on bequests (cf. Laitner and Ohlsson (2001) and Masson and Pestieau (1997)), for example, altruistic motives (wanting ones children to be well off), exchange motives (expecting something in return from ones offspring) or "egoistic" motives (enjoying giving) all lead to bequeathing something to posterity. Bequeathing something out of a respect for the rights of our descendants, however, is a motive still different. One can give out of a respect for rights without exhibiting beneficence in the sense of genuinely wanting the receiver to be well off, without expecting something in return and without the "warm glow" of giving.

The specific example of a right employed here – a right to $\overline{U}$ – should be seen as a strong simplification for the purpose of exploring the general logic of rights, in particular of rights ascribed by a theory of intergenerational distributive justice.[14] Such a theory could specify the level of $\overline{U}$ in

[14] The right to a certain wellbeing level is chosen here because it links up most seamlessly with traditional economic ways of formalizing utilitarianism while still exhibit-

egalitarian terms (making $\overline{U}$ equal to or at least dependent on U_1) or, more plausibly, in non-relative, sufficientarian terms (ascribing, for example, a human right to subsistence, or a right – in the words of the famous Brundtland definition of sustainability – to the ability to meet one's needs, or even less minimal rights) (cf. Meyer and Roser (2009)). Both represent widely shared intuitions and express the idea that whereas we do not have a duty to sacrifice one unit of our own wellbeing whenever this increases future wellbeing (possibly discounted) by more than a unit, our descendants do have a right to be left with enough or equally much as we have. Since there are a number of theorists who are skeptical of rights language when it comes to future generations but who are much less hesitant to speak of duties or obligations with respect to future generations – such as a duty to guarantee basic needs or to avoid deprivation –, it is important to note that duties often involve the same characteristics as rights (as presented above) and can therefore also be analyzed within the present framework. A number of concrete policies which are concerned with not exceeding certain thresholds in the future can also be framed as having the same structure as policies which ascribe a right to future generations to $\overline{U}$, for example the objective of the European Union to ensure that temperature increase stay below the 2°C threshold, the objective of the UN Framework Convention on Climate Change to avoid crossing the threshold where there is "dangerous interference with the climate system" or the precautionary approach in principle 15 of the Rio Declaration which makes reference to the threshold where there

ing the basic features that distinguish a rights-sensitive from a utilitarian decision-maker. The right to $\overline{U}$ could, however, equally well exemplify some basic features of more complex rights, such as fundamental human rights, rights of non-human nature, rights ascribed by a theory of intergenerational justice but with a richer metric than utility, or legally codified rights.

One could also model such more general rights more explicitly. This could be done by including a variable R in the choice problem. Rights would count as fulfilled when R takes the value $\overline{R}$. Typically, achieving $\overline{R}$ would have to be modelled as being costly. One could imagine various models, in particular one could model R as only taking one value below $\overline{R}$ (in case the right cannot be violated more or less gravely) or as taking no value above $\overline{R}$ (in case there is no sense in which the right can be overfulfilled).

is "serious or irreversible damage" to the environment.

3.3.2 Formalizing Rights

In this section, the choice problem of a rights-sensitive decision maker will be expressed in a formal way. The model we are looking for has to capture how a rights-sensitive decision-maker – in contrast to a utilitarian decision-maker – takes the concerns of others into account in a different way from his own concerns: Up to the threshold where rights are fulfilled, the concerns of others take precedence over his own concerns – even if this should decrease aggregate utility. Beyond the threshold his own concerns take precedence over those of others – even if this should decrease aggregate utility. The formalism of the following sections can be used to represent any kind of policy choice based on this logic, whether couched in terms of rights or not. It is, however, most naturally interpreted for the case of a right to a certain utility level based on considerations of distributive justice.

Three alternative versions which represent the logic of rights in different ways are presented: The Side Constraint Model, the Penalty Model and the Concavity Model. The reason for discussing three alternative versions lies in the fact that it is not at all uncontroversial how to capture the subtle logic of rights. And since we are ultimately interested in examining the claim that rights imply risk aversion we show that different ways of capturing the above mentioned features of rights thinking all serve to show the link to risk-aversion.

The Side Constraint Model

In a world of certainty ($\sigma_2^2 = 0$), a straightforward way of representing the essence of rights models them as side constraints:

$$\max U_1$$

$$\text{s.t. } U_i \geq \overline{U}.$$

Increasing U_2 is given complete precedence over the maximization of U_1 until U_2 reaches the threshold of $\overline{U}$. When that threshold is reached, increasing U_1 is given complete precedence over increasing U_2. Ascribing such lexical priority to the right of future generations satisfies all of the above mentioned features of rights thinking.

Difficulties enter, however, when this rights-sensitive choice problem is extended to the case of uncertainty. How should the side constraint be modified if U_2 is a random variable? Future generations are owed $\overline{U}$ but what the present generation can influence is only the probability distribution over U_2 rather than the actual U_2. The situation of the present generation with respect to the future generation is similar to someone who owes you \$10 but only has lottery tickets rather than money at hand. What kind of lottery ticket would count as that person having payed back his debt to you (without being able to ask for your agreement)? We now present five suggestions for generalizing the side constraint to the context of uncertainty. The last of these five suggestions will be deemed satisfactory and will be labelled the "Side Constraint Model".

Firstly, the absoluteness associated with the right to $\overline{U}$ in a world of certainty might suggest that in a world of uncertainty there is a duty to push the probability of U_2 falling below $\overline{U}$ down to zero. This suggestion is a non-starter, however: Pushing this probability down to zero may either be impossible or else imply burdens for the present generation which are so high as to involve trade-off resistance to an implausibly extreme extent.

Secondly, and for the same reasons, the side constraint cannot be modelled as a duty to minimize the probability of the future generation falling below $\overline{U}$. While some policy proposals in the real world admittedly use the language of minimizing the probability of outcomes such as catastrophic climate change, this language cannot be taken literally in cases where this probability could be brought ever closer to zero at ever larger costs.

Thirdly, and slightly more promising, one might have the intuition that

if the future generation is owed $U_2 \geq \overline{U}$ in a world of certainty, it is owed $E[U_2] \geq \overline{U}$ in a world of uncertainty. Richard Howarth's proposal for "sustainability under uncertainty", for example, involves this idea.[15]

The problem with this approach, however, is that a right to x cannot in general be fulfilled by the expectation of x. A particularly clear example is given by the following thought experiment. Assume that a psychotic plays a strange game without your permisssion: He throws a coin and if head comes up, he will steal \$5 from you and if tail comes up he will put \$50 in your mailbox. Even though the game yields an expected gain of more than \$20 for you, your rights make it impermissible for the psychotic to carry out this game. His duty consists in not stealing from you rather than in not stealing from you *on average*. The logic of rights does not allow in a straightforward way to weigh up potential rights violations with potential "supererogatory" outcomes (i.e. those outcomes which benefit others by going beyond one's duty).

Still, this third view contains a grain of truth. While a side constraint to the effect that $E[U_2] \geq \overline{U}$ may not be *sufficient* for the present generation to respect the rights of future generations it seems at least *necessary*. We will assume in the rest of this chapter that any plausible version of formalizing the choice problem of a rights-sensitive decision-maker incorporates a side constraint to this effect. The three versions to be discussed will only be concerned with what it is that rights imply *additionally* to the side constraint that $E[U_2] \geq \overline{U}$.

A fourth approach towards generalizing the side constraint to the context of uncertainty translates the right to $\overline{U}$ into a duty to keep the probability of falling below $\overline{U}$ sufficiently small, i.e. smaller than some given parameter. The parameter would have to be smaller than 0.5 because already the third

[15] Howarth (1995, p. 422) suggests that a "deontological approach" to intergenerational fairness (something very close to what we labelled rights thinking), implies maximizing with a side constraint where the side constraint demands that welfare at time t not exceed welfare at $t+1$. In order to generalize his approach to risk, he suggests that the side constraint must be translated into the demand that *expected* welfare at t not exceed *expected* welfare at $t+1$.

approach demands – at least in the case of a symmetric distribution of U_2 – that the probability of falling below $\overline{U}$ be less than 0.5.

Something analogous is for example suggested by Krysiak and Krysiak (2006, pp. 516–17) in their own model of sustainability under conditions of uncertainty. This fourth approach is also in line with the language of many real world policy discussions. The Greenhouse Development Rights Framework (see Baer et al. (2008)), for example, takes the goal of limiting temperature increase to 2° as a goal to stay below 2° with a probability of 70-85%.

The problem of the fourth approach is its exclusive focus on the probability of falling below the rights threshold without at all taking note of *how much* the future generation might fall below the threshold. Particularly in the case of climate policy where catastrophes and thick tails are an important issue (cf. Weitzman (2009)), taking note of the shape of the distribution below the threshold is crucial. Not all rights violation are equally grave.

The fifth and final approach differs from the fourth suggestion by weighting rights violations by their graveness.[16] What must be sufficiently small, i.e. smaller than some given parameter, is the probability of violating rights multiplied by the average graveness of rights violations.[17] We conceive of the average graveness of a rights violation as the expected utility shortfall from the threshold level which is owed to the future generation.[18] Some people

[16] By making the analogy to financial risk measures, we could say that the fourth approach suffers from similar shortcomings in comparison to the fifth approach as the Value at Risk does in comparison to the Conditional Value at Risk. Note also that in terms of their mathematical structure, the fourth and the fifth approach – including the variations of the fifth approach mentioned in fn. 18 – are special cases of lower partial moments.

[17] According to Jensen (2002, p. 46), part of the interpretation of the precautionary principle by the Commission of the European Communities (2000) can be understood along these (or similar) lines, *viz.* that a risky action is unacceptable if the severity of harm multiplied by the probability of harm exceeds some threshold.

[18] A further development of the Side Constraint Model might also consider giving disproportionate weight to large rights violations rather than weighting rights violations linearly according to their distance from the utility threshold. It could either overweight or underweight large rights violations. The latter could – in accordance

use the term "risk" in the sense of the probability of a bad event multiplied by the magnitude of the bad event, and in that sense the Side Constraint Model demands nothing else than a sufficiently small risk of rights violations. It formalizes the choice problem of a rights-sensitive decision-maker as follows (where β is a normatively determined parameter):

The Side Constraint Model

$$\max U_1$$

$$\text{s.t.} \int_{-\infty}^{\overline{c}} (\overline{U} - U(c_2))\, dF_2 \leq \beta$$

$$\text{s.t. } E[U_i] \geq \overline{U}$$

By modelling the right of the future generation in terms of a side constraint the Side Constraint Model captures something essential about our rights thinking: The concerns of others do not enter our decision as something merely to be given a certain weight – regardless of whether that be equal or less weight than our own concerns – but the concerns of others enter our decision in a fundamentally different way than our own concerns. Up to the point where the side constraints – i.e. the rights of others – are fulfilled, the concerns of others trump our own concerns whereas in the "supererogatory territory" of a fulfilled side constraint our own concerns trump those of others.

There are, however, also problems to the Side Constraint Model. One problem – of a rather practical nature – is that it does not link up very naturally with existing economic models of intertemporal allocation which add up present and future utility and maximize the sum. The logic of the Side Constraint Model which relegates the future generation's utility into a side constraint is very discontinuous to this approach. A second and more

with the idea of trade-off resistance – be justified by the idea that a rights-sensitive approach is mainly concerned with whether rights are violated and only to a smaller extent with whether they are violated gravely or not.

fundamental problem is the following. While the the Side Constraint Model does justice to all of the above mentioned features of rights-sensitivity it does "too much justice" to the feature of trade-off resistance. By giving lexical priority to keeping the risk of rights violation smaller than β, the Side Constraint Model is extreme. Most people view at least some rights violations as permissible (in which case they may be called rights infringements rather than rights violations (cf. Thomson (1986))). The permissibility depends *inter alia* on what is gained thereby (cf. McCarthy (1997, p. 209)). It is a perennial problem both to common sense and to moral philosophy to come up with a coherent account of rights which is neither implausibly rigorous in making rights "too" stringent nor embarks on a slippery slope to utilitarianism in making them not stringent enough. We cannot find a conclusion to this perennial tension here. What can be concluded, however, is that the Side Constraint Model lies too much on the former (stringent) end of the scale. In being exclusively concerned with a sufficiently low "downside risk" for the future generation, the Side Constraint Model takes into account neither the costs to the present generation of limiting the risk of rights violation down to β nor the foregone "upside potential" for the future generation. In other words: If it were possible to increase either the utility of the present generation or the expected utility of the future generation tremendously by exceeding β by an extremely small amount, this would be ruled out by the Side Constraint Model. It is therefore valuable to sketch two versions which make rights less stringent.

The Penalty Model

The Penalty Model links up with the standard utilitarian choice problem in including the utilities of all generations in the maximand of the choice problem. In addition to the utilities, however, it also includes the fulfillment of rights in the maximand. Formally, what enters the maximand besides U_1 is a transformation V_2 of the utility function U_2 which involves a penalty $\gamma > 0$ for utility below $\overline{U}$ (see figure 1 below):

$$V_2 = \begin{cases} U_2 - \gamma & \text{if } U_2 < \overline{U}; \\ U_2 & \text{if } U_2 \geq \overline{U}. \end{cases}$$

It formalizes the choice problem of a rights-sensitive decision-maker as follows:

The Penalty Model

$$\max \left(U_1 + E[V_2]\right)$$

$$\text{s.t. } E[U_i] \geq \overline{U}$$

This can also be written as:

$$\max \left(U_1 + E[U_2] - \gamma \int_{-\infty}^{\overline{c}} dF_2 \right)$$

$$\text{s.t. } E\left[U_i\right] \geq \overline{U}.$$

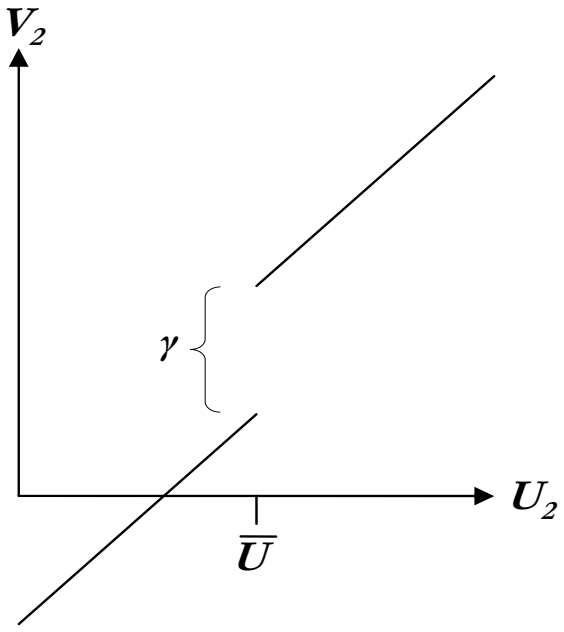

Figure 1

Judging the merits of the Penalty Model amounts exactly to the opposite of the Side Constraint Model. While the Side Constraint Model is not aligned with standard economics, the Penalty Model is much more so (except for the non-differentiability of the function V_2). And while the Side Constraint Model is too stringent with respect to trade-off resistance, the Penalty Model is too lax. It is too lax because any full-blown rights theory is less crude in its resistance to trade-offs than simply attaching a disvalue γ to rights violations which has to be counterbalanced by gains in utility in order for rights violations to be permissible. Still, even if human thinking about trading off rights is more subtle than that, it usually does make the permissibility of rights violations *dependent*, in some way or other, on what is gained by a rights violation – and this general feature is mirrored in the Penalty Model.[19] One feature of rights thinking which is not modelled by the Penalty Model is the fact that the present generation is not obliged to give future utility above $\overline{U}$ the same weight as its own utility.

The Concavity Model

The last version to be discussed relies only on differentiable functions. It represents rights by modelling the core idea that the present generation has much less reason to increase future utility when future utility above $\overline{U}$ is at stake than when future utility below $\overline{U}$ is at stake. That is: the marginal value of the future generation's utility above $\overline{U}$ is very small in the present generation's choice problem. It decreases even further the further the future generation is above $\overline{U}$. However, below $\overline{U}$, the marginal value of the future

[19] Some may want to claim that the only type of "gain" which could make a rights violation permissible is the protection of other rights and that no gain in mere wellbeing could make up for however small of a rights violation (cf. Jensen (2002, pp. 50–51)). (In practice, it is not always easy to keep these two types of gains as justifications for rights violations apart: While it may seem, for example, that the risks car drivers impose on bystanders are made permissible by the comparatively large benefits they derive from their mobility it may in reality be the car drivers' *right to* mobility which does the justificatory work). It should be noted that the stylized logic of the Penalty Model is not apt to capture the position which only allows trade-offs among rights.

generation's utility is very large in the present generation's choice problem. And it increases further the further below $\overline{U}$ the future generation is.

In order to formalize this idea, use g to denote a strictly concave function. Use $W_2(c_2) = g\,(U(c_2))$ to denote the function that enters the maximand of the present-day decision-maker besides U_1 (see figure 2 below). The following assumptions are made:

$$\frac{\partial W_2}{\partial c_2}\Big|_{c_2=\overline{c}} = \frac{\partial U_2}{\partial c_2}\Big|_{c_2=\overline{c}}$$

$$\frac{\partial W_2}{\partial c_2} \geq 0 \text{ for any } c_2$$

The choice problem of the present generation according to the Concavity Model can then be stated as follows:

The Concavity Model

$$\max\,(U_1 + E[W_2])$$

$$\text{s.t. } E[U_i] \geq \overline{U}.$$

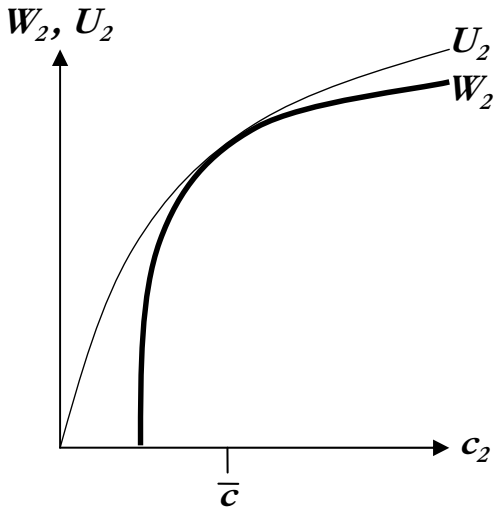

Figure 2

The Concavity Model maps human thinking about rights into a formal model by means of imputing a concave transformation of the future generation's utility function into the present generation's choice problem. This mirrors the fact that for the present generation who decides on policy the utility of future generations is very important up to $\overline{U}$ and hardly important beyond $\overline{U}$. It is interesting to note that it is, at least in one respect, structurally similar to loss-averse utility functions: It sets a reference point and makes the value function below the reference point steeper than the original utility function. A rights violation plays a similar role in the rights-sensitive choice problem as a loss plays in loss-averse utility functions.

It is important not to confuse the Concavity Model with the different idea that future generations could possibly have a more concave utility function than the present generation. The claim of the Concavity Model is that *even if* (as assumed in this chapter) the present and future generation have exactly the same utility function (that is: even if they draw wellbeing in exactly the same way from consumption), the present generation's choice problem should use a concave transformation of the future generation's utility function. This is not to say that there might not be *additional* reasons to work with a more concave utility function than typically assumed in climate economics. Actually, many of the intuitive reasons for strong risk-aversion which are brought forth in public discussions on climate policy can be interpreted as implicitly making the *empirical* claim that the relationship between utility on the one hand and consumption, temperature increase, or emission concentration on the other hand is much more concave than it seems at first sight. This might be so in particular due to such effects as non-linearities and tipping points in the global ecosystem, the social amplification of risk (cf. Sunstein (2007, p. 138)), or a belief that the marginal wellbeing of consumption becomes very low once a certain living standard is achieved.

The advantages and disadvantages of the Concavity Model are similar to the Penalty Model. It is even more aligned with existing economic modelling

than the Penalty Model because it only involves smooth functions. This feature, however, comes at the cost of mirroring the threshold aspect of rights less clearly. As far as trade-offs are concerned, it does justice to our intuition that rights are not totally immune to trade-offs and that the permissibility of rights violations must in some way depend on what is gained by a violation. Similarly to the Penalty Model, however, the principle for allowing trade-offs is cruder than that of any full-blown rights theory.

Summary

The goal of this section consisted in formalizing rights. Since it is a delicate issue how to model rights, we suggested three alternative formalizations, each stressing different aspects of the logic of rights. The Side Constraint Model packs the right of the future generation into a side constraint and demands that the probability and graveness of potential rights violations be kept sufficiently small. The Penalty Model and the Concavity Model mirror the right of the future generation by a transformation of the future generation's utility function which enters the maximand of the present generation's choice problem. The former inserts a jump at $\overline{U}$, the latter employs a concave transformation. They differ in particular with regard to how sensitive they make the fulfillment of rights on the costs of doing so, i.e. on how resistant to trade-offs they make rights. The presented versions are by no means exhaustive. And: they can easily be combined with each other. The Concavity Model could, for example, additionally involve a penalty for rights violations. The specific shapes of V and W could also be modified, both below and above $\overline{U}$. And one could combine the Penalty or the Concavity Model with the Side Constraint Model.

These three alternative ways of modelling the choice problem of a rights-sensitive decision-maker will now be examined with respect to the risk-aversion they imply. Even though all three versions stress different aspects of rights thinking, they will be shown to *all* imply an additional kind of risk-aversion compared to the risk-aversion of a utilitarian decision-maker.

3.4 Rights and Risk-Aversion

We examine the claim that a rights-sensitive decision-maker exhibits additional risk-aversion compared to a utilitarian decision-maker by proving three results. The risk-aversion of a rights-sensitive decision-maker is labelled "additional" because the rights-sensitive decision-maker accepts the reason for risk-aversion put forward by utilitiarianism – i.e. the curvature of the utility function – but has reasons for risk-aversion on top of that – i.e. the manner in which other agents' utilities enter his choice problem.

3.4.1 Definitions

The choice problems we examine depend on two arguments (c_1 and c_2) rather than on one argument. Even though we are only interested in risk-aversion with respect to c_2, this case still diverges from the standard textbook case of univariate risk-aversion. In terms of a preliminary task, we therefore first have to define risk-aversion for such a multivariate case. The fact that we are operating with a multivariate choice problem explains why we are precluded from employing a straighforward comparative notion of "more risk-averse" (since there are no such straightforward notions, see e.g. Dorfleitner and Krapp (2007); Hellwig (2004); Kihlstrom and Mirman (1981)).

For ease of exposition, we couch the definitions in the terms of the present model, i.e. we presuppose decision-makers with a choice problem dependent on $U(c_1)$ and $U(c_2)$, where c_2 is stochastic.

> **Definition 1**
> *For a given c_1, the **Certainty Equivalent (CE_2)** for F_2 is the lowest c_2 which the decision-maker does not dispref to F_2.*

This is a slight generalization of the standard definition of the Certainty

Equivalent in order to include cases where there might be either no or more than one c_2 for which a decision-maker is indifferent between c_2 and F_2.

Definition 2
A decision-maker is risk-averse w.r.t. c_2 (***risk-averse***$_{c_2}$)
if
(i) *for any* c_1 *and any* F_2, $CE_2 \leq \mu_2$ *and*
(ii) *for any* c_1 *there is at least one* F_2 *for which* $CE_2 < \mu_2$.

This definition is similar to partial risk-aversion as defined by Dorfleitner and Krapp (2007). It allows us to say that a decision-maker is risk-averse$_{c_2}$ if – given any c_1 – the decision-maker is always willing to have F_2 replaced by μ_2 and is willing to have at least one F_2 replaced by a c_2 lower than μ_2.

The notions of risk-loving$_{c_2}$ and risk-neutral$_{c_2}$ can be defined analogously, i.e. by reversing the inequalities or by replacing them by equalities, respectively.

3.4.2 Results

We now characterize the additional risk-aversion of a rights-sensitivite decision-maker by proving three results. First, a Proposition: The certainty equivalent of a rights-sensitive decision-maker for any F_2 is lower than or equal to the certainty equivalent of a utilitarian decision-maker, but not *vice versa*. Second, a Corollary: For any specification of the utility function for which the utilitarian decision-maker is risk-averse, the rights-sensitive decision-maker is risk-averse, too, but not *vice versa*. Third, a Theorem: A rights-sensitive decision-maker is risk-averse for all concave – including linear – utility functions.

We start by showing that the proposition holds for all three versions of modelling rights. We restrict ourselves to the case where F_2 is such that $E[U_2] \geq \overline{U}$ and $Prob(U_2 < \overline{U}) > 0$. The proofs for the other cases are in the appendix.

The Side Constraint Model

According to the Side Constraint Model, the CE_2 of a rights-sensitive decision-maker is either $\overline{c}$ (in case the LHS of the side constraint is smaller than or equal to β) or else $-\infty$ (in case the LHS is larger than β). According to utilitarianism, the CE_2 is either $\overline{c}$ (in case $E[U_2] = \overline{U}$) or else larger than $\overline{c}$ (in case $E[U_2] > \overline{U}$).

Therefore, the CE_2 of a rights-sensitive decision-maker according to the Side Constraint Model is either equal to or, in most cases, lower than the CE_2 of the utilitarian decision-maker.

The Penalty Model

The Penalty Model is distinguishable from utilitarianism only by its inclusion of a "penalty term" $(-\gamma \int_{-\infty}^{\overline{c}} dF_2)$. Because this term is negative for any F_2 extending below $\overline{U}$, the CE_2 of a rights-sensitive decision-maker is lower than the CE_2 of a utilitarian decision-maker.

There is one exception to this: In case $E[U_2] = \overline{U}$, the CE_2 is $\overline{c}$ not only for for the utilitarian decision-maker but also for the rights-sensitive decision-maker. This is so due to the jump in V: There is no c_2 below $\overline{c}$ which the rights-sensitive decision-maker would not strictly disprefer to F_2 in that case (even though he neither prefers F_2 over $\overline{c}$ in that case).

Therefore, the CE_2 according to the Penalty Model is equal to or, in most cases, lower than the CE_2 of the utilitarian decision-maker.

The Concavity Model

By standard microeconomics, a concave transformation of an objective function implies a lower Certainty Equivalent than the original objective function. Therefore a rights-sensitive decision-maker trivially has a lower Cer-

tainty Equivalent than the utilitarian decision-maker according to the Concavity Model.[20]

We can thus conclude that the following result holds for *all* three versions of modelling rights-sensitivity:

> **Proposition**
> (i) *For any c_1 and any F_2, the CE_2 of a rights-sensitive decision-maker is equal to or lower than the CE_2 of a utilitarian decision-maker.*
> (ii) *For any c_1 there is at least one F_2 for which the CE_2 of a rights-sensitive decision-maker is lower than the CE_2 of a utilitarian decision-maker.*

The Proposition supports the claim that a rights-sensitive decision-maker exhibits additional risk-aversion compared to a utilitarian decision-maker. The former is often willing to give up more (and never willing to give up less) expected utility of the future generation in order to do away with uncertainty for the future generation (holding his own consumption fixed). The present-day decision-maker is thus more hesitant to bequeath risky outcomes to his descendants when relying on a rights-sensitive choice problem than when relying on a utilitarian choice problem.

The Corollary to this result gives further substance to the claim about additional risk-aversion. It follows directly from the Proposition: By (i), the CE_2 of a rights-sensitive decision-maker is always equal to or lower than the CE_2 of a utilitarian decision-maker. Therefore, a rights-sensitive

[20] The meat of the analysis resides of course not in the trivial fact that a more concave function implies additional risk-aversion but the points of substance are rather the facts that, first, a concave transformation of the objective function can be interpreted as a representation of rights-sensitivity (and therefore rights-sensitivity implies additional risk-aversion) and, second, that this link between rights and risk-aversion holds for other ways of modelling rights as well.

decision-maker is risk-averse$_{c_2}$ for any specification of U for which the utilitarian decision-maker is risk-averse$_{c_2}$. And by (ii) from the Proposition, the CE_2 of a rights-sensitive decision-maker is strictly lower than the CE_2 of a utilitarian decision-maker for at least one F_2. This implies that the rights-sensitive decision-maker is risk-averse$_{c_2}$ even if the utilitarian decision-maker is risk-neutral$_{c_2}$ (and sometimes even if he is risk-loving$_{c_2}$). Together, this yields:

Corollary
For any specification of U for which a utilitarian decision-maker is riskaverse$_{c_2}$, a rights-sensitive decision-maker is risk-averse$_{c_2}$, too, but not vice versa.

The rights-sensitive decision-maker is therefore risk-averse$_{c_2}$ in more cases than the utilitarian decision-maker. The following Theorem is based directly on the Corollary: Since a utilitarian decision-maker is risk-neutral$_{c_2}$ in case of a linear utility function and risk-averse$_{c_2}$ in case of a strictly concave utility function and since a rights-sensitive decision-maker is risk-averse$_{c_2}$ if the utilitarian decision-maker is either risk-neutral$_{c_2}$ or risk-averse$_{c_2}$, the rights-sensitive decision-maker trivially is risk-averse$_{c_2}$ for *any* concave utility function, including linear utility functions.

Theorem
A rights-sensitive decision-maker is risk-averse$_{c_2}$ for any concave specification of U.

By pointing out that the rights-sensitive decision-maker exhibits risk-aversion$_{c_2}$ even for linear utility functions, the Theorem makes plain how rights-based risk-aversion derives from other grounds than the curvature of the utility function.

3.4.3 Discussion and Implications

These results imply that it does not suffice to base the evaluation of long-term policies on average numbers only. For a rights-sensitive decision-maker, the relevance of uncertainty extends beyond its effect on *expected* utility. In the area of climate policy, for example, we cannot compare investments into mitigation with investments into adaptation by only comparing the *expected* returns of the two strategies.

The logic of such rights-based risk-aversion is amenable to intuition. The utility functions of agents other than the decision-maker enter the choice problem in a reference-dependent manner. Reference-dependence has become an important rationale for explaining risk-attitudes in recent years. But while the reference point in the models which have become prominent – such as loss-aversion models – is for example constitued by the status quo, the reference point which is at stake in the context of rights thinking is a rights threshold. For the policy-maker who decides on issues which affect not only himself it is in a distinct way very important not to let other agents fall below the rights threshold and it is in a distinct way not very important to benefit other agents beyond the rights threshold. This particular way in which the rights threshold is relevant can be modelled by a side constraint, by a penalty or by adjusting the marginal value of utility above and below the threshold. In whatever way rights are modelled, the asymmetry of ascribing a particularly large disvalue to the downside risk of falling below $\overline{U}$ while ascribing a particularly low value to exceeding $\overline{U}$ generates risk-aversion.

Graphically, the point can be appreciated by comparing two probability distributions over future utility. A rights-sensitive policy-maker will often prefer the probability distribution with the lower variance even if it goes along with a lower expected utility. Since his primary concern is the avoidance of rights violations, his main focus in the comparison of probability distributions is the size and shape of the area below $\overline{U}$ rather than the mean.

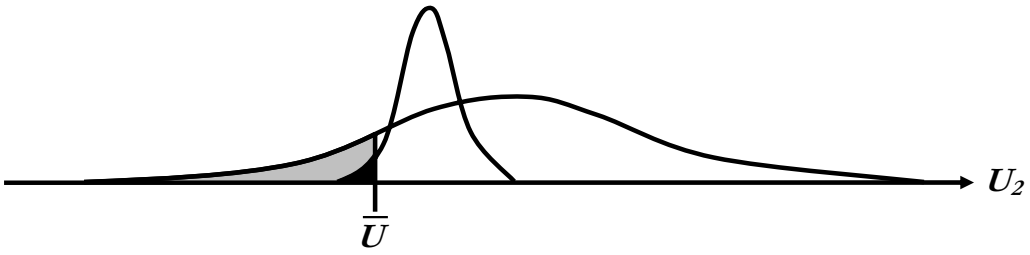

Figure 3

This also reveals how distributive justice is a more rigid yardstick with respect to uncertainty than aggregate utility: In an uncertain environment, the sum of expected utilities may be a good measure for characterizing the "size of the pie" but the distribution of expected utilities is not a good measure for characterizing the justice of the "split of the pie".

It is interesting to observe that the right to $\overline{U}$ often implies a duty of the present generation to aim at a $E[U_2] > \overline{U}$ (but never a duty to aim at a $E[U_2] < \overline{U}$). In other words, the logic of rights under conditions of uncertainty leads to a duty to "*overshoot*". If, for example, the right of future generations is couched in egalitarian terms, the duty of the present generation will often consist in working towards a path of *rising* expected utility. The right of future generations to be at least as well off as the present generation is often not be fulfilled by a path of constant expected utility. The call for overshooting might be labelled as a duty to include a margin of safety or a duty to err on the side of caution when rights are at risk. It expresses one of the core intuitions behind the precautionary principle.

What does this chapter imply for the determination of the correct discount rate? In economics, discussions of intergenerational justice usually focus exclusively on discounting. Our reasoning, in contrast, implies that doing justice to future generations is not primarily about choosing the right discount rate. It is rather about replacing utilitarianism by a rights-sensitive approach. Choosing an appropriate discount rate is only an important task within the confines of utilitarianism. In a rights-sensitive choice problem,

the goal of giving neither too much nor too little consideration to the concerns of posterity is achieved by other means than by adjusting the discount rate.

One might still wonder, however, whether the message of this chapter cannot at least be *translated* into a prescription regarding the choice of discount rate. At first sight, this seems impossible. The discount rate determines the *weight* of future utility relative to present utility while a rights-sensitive choice problem determines *which part* of future utility is relevant *in what way* for present-day policy choice. More precisely: Standard economic models sum utilities over time and multiply each utility by a discount factor. The logic of rights, in contrast, involves non-linear transformations of utilities and relegates some utilities from the objective function into the side-constraint. At second sight, however, the Penalty Model and the Concavity Model can partly be mimicked by a discounted utility model. In order to do so we need the help of a state-dependent discount factor, i.e. we can represent both V_2 and W_2 by multiplying U_2 with a factor which is dependent on c_2.[21]

We cannot, however, mirror the Penalty and the Concavity Model completely by modelling them in the structure of a utilitarian model with a state-dependent discount factor. This is so because both of these models involve a side constraint to the effect that $E[U_2] > \overline{U}$. There is no factor we could place infront of future utility which would mimick this side constraint. Such a discount factor would have to make the expectation of discounted utilities sum up to $-\infty$ in case the expectation of undiscounted utilities sums up to less than $\overline{U}$ and it would have to make for the representation

[21] There are two technicalities to be taken note of: First, since there is no discount rate corresponding to a negative discount factor, we want the discount factor always to be positive. The state-dependent discount factor which generates V_2 or W_2 by multiplication with U_2, however, can in general only escape taking on negative values in some cases if U_2 is either positive everywhere or negative everywhere in the range of interest to us. Since utility functions are only unique up to positive affine transformations, this is not much of a problem except for utility functions which are unbounded below and above. Second, the correct state-dependent discount factor which is necessary to represent the Penalty or the Concavity Model cannot be determined independently of the utility function at hand.

of V_2 or W_2 otherwise. This is impossible. For analogous reasons, the Side Constraint Model cannot be framed as a utilitarian choice problem with a state-dependent discount rate.

How can we apply the message of this chapter to climate economics? One suggestion is to give priority to cost-effectiveness studies over cost-benefit-analyses. Cost-effectiveness studies (and related approaches) calculate the most efficient path to achieve an exogenously given goal rather than aiming at the goal of maximizing net present value (cf. IPCC (2001, ch. 10.1.3.1)). The exogenously given goal can be interpreted as a side constraint representing the rights of future generations in the sense of the Side Constraint Model.

Based on the Concavity Model, climate economists might also use a concave transformation of the utility function for points of time in the further future. Or, based on the Penalty Model, they might ascribe particular disutility to consumption levels below (for example) the poverty line.

This chapter also underlines the importance of the communication of uncertainty. For rights-sensitive policy-makers, uncertainty can make all the difference in the evaluation of policies. Therefore, science should place large importance on carefully communicating the uncertainty of relevant variables rather than only communicating their expectation or mode. The IPCC is exemplary in this respect (cf. IPCC (2007, p. 27)).

3.5 Conclusion

This chapter presented various ways of modelling the difference between a rights-sensitive and a utilitarian decision-maker. We claim that on any of these ways, the special importance a rights-sensitive decision-maker gives to the fulfillment of rights of other agents and the low importance he may give to benefiting other agents apart from fulfilling their rights implies risk-aversion. This risk-aversion is additional to the kind of risk-aversion – based

on the curvature of the utility function – already endorsed by the utilitarianism of standard economics. It is based on how the utilities of other agents enter the decision-maker's choice problem and it therefore concerns risks which are *imposed* rather than risks which are *taken*.

The practical import of this conclusion for climate policy is the following. In current discussions, there is a clash between proponents of the precautionary principle and proponents of economic cost-benefit analysis. The former stress the intuitive idea that the uncertainty associated with unabated climate change yields a strong reason to rely on low-risk policies such as mitigation. They claim that this uncertainty-based reason for mitigation is stronger than standard economics can acknowledge. The latter observe that the literature on the precautionary principle has so far been less than successful in making its intuitive ideas precise and in justifiying its rationales for risk-aversion. This chapter agrees with both sides of the divide. It agrees with proponents of the precautionary principle that we actually do have more reason to eschew uncertainty than acknowledged within the utilitarian framework of standard economics. But it also agrees with the other side that this claim needs a sounder foundation than it has been given so far. This chapter offers such a foundation by arguing that respect for the rights of future generations implies risk-aversion.

Appendix

In order to complete the proofs, we need to show that the proposition holds also in the two cases which were not treated in section 3.4.2. First, there is the case where F_2 is such that $E[U_2] < \overline{U}$. Second, there is the case where $E[U_2] \geq \overline{U}$ but $Prob(U_2 < \overline{U}) = 0$. Both cases are not of genuine practical significance.

The proposition holds true in the first case because all three versions of rights-sensitive choice problems incorporate a side constraint to the effect that $E[U_2] \geq \overline{U}$. Given this side constraint, the CE_2 for any F_2 for which $E[U_2] < \overline{U}$ is $-\infty$. This infinitely negative CE_2 is either lower than or, in special cases, equal to the CE_2 of a utilitarian decision-maker.

In order to show that the proposition holds true also in the case where F_2 is such that $Prob(U_2 < \overline{U}) = 0$ we must examine the three rights models in turn.

In case of the Side Constraint Model, the CE_2 for such an F_2 is $\overline{c}$. This is lower than (or, in the special case that $E[U_2] = \overline{U}$ and $\sigma_2^2 = 0$, equal to) the CE_2 of the utilitarian decision-maker.

In case of the Penalty Model, the choice problem of the rights-sensitive decision-maker is indistinguishable from the utilitarian's choice problem and therefore the CE_2 of the two decision-makers is equal. It suffices to show that they are equal, however, since for the Proposition to be true it suffices that the CE_2 of the rights-sensitive decision-maker is lower for *at least one* F_2. And this has already been shown in section 3.4.2 for cases of F_2 with support extending below $\overline{U}$.

In case of the Concavity Model, the result flows trivially from the concave transformation of the utilitarian objective function.

4 Historical Emissions and Climate Justice

4.1 Introduction

Climate change can be seen as a unique case of historical injustice involving a complex intersection of global and intergenerational justice. It also involves a diversity of goods and bads: first, the benefits of engaging in emission generating activities, such as driving cars, growing rice, or engaging in deforestation,[22] second, the climate damages which are a side effect of these activities, and third, payments which allow for adaptation measures to these climate damages. Some of the notable features of the climate change issue are: first, in the past it was predominantly the North which created climate change. Second, the South is more vulnerable to climate change. This is due to geographical factors (e.g. the higher temperature in the South already before climate change occurs), the higher reliance on agriculture (an especially vulnerable sector) and the lower adaptive capacities. Third, much of the climate change that is caused by emissions materialises with a time lag of several decades after the occurrence of those emissions. The following figure *inter alia* displays some of these features, where "region X" is a blank

[22] For simplicity's sake, we refer also to deforestation and other ways of decreasing sinks as emission generating activities. An umbrella term which would more precisely capture both – activities which add emissions to the atmosphere and activities which diminish the removal of emissions from the atmosphere – would for example be "emission concentration enhancing activities". Note also that under a converse perspective these benefits can be seen as costs, i.e. as what has to be foregone in order to pursue mitigation measures (such mitigation burdens, however, not only include the direct costs of stopping to engage in emission generating activities but include, more indirectly, also transfers to pay others for mitigation measures and funding for research).

that can be filled in with either "the North" throughout the figure or with "the South":

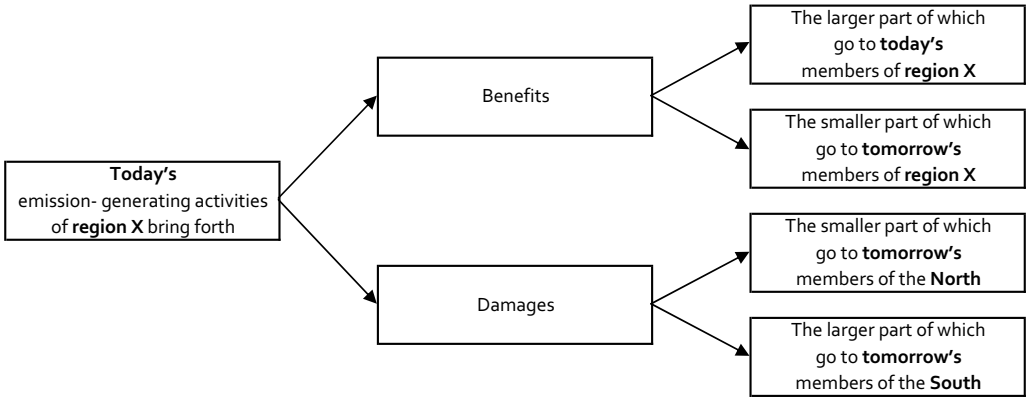

Figure 4

The structure of the problem as shown in the above figure suggests that the distribution of emission rights on the one hand and a fair way of dealing with climate damages on the other hand is a rather complex matter. The problem seems to be *sui generis*. In particular it differs from the standard problem of how to respond to historical injustices (cf. Gosseries (2004, p. 37); on the topic of historical injustice in general see Meyer (2004, 2005)). In standard cases of historical injustice, we often face the problem that earlier generations of one community wronged earlier generations of another community and today's generations of both communities are now looking for an adequate way of responding to this historical fact and its impact on the well-being of currently living and future people. In the climate change debate, however, we are faced with the situation that earlier generations of one community (the North) *directly* effect something to the detriment of later generations of the other community (the South).[23] It also differs from some

[23] One implication of this is that it makes one of the answers to historical injustice more difficult to sustain, namely the answer which argues that one should compensate

other cases of historical justice in that it is not a problem of exclusively one generation/community being wronged and exclusively another generation/community having committed the wrongs and/or wrongfully benefiting. Rather, victims, wrongdoers, and beneficiaries are dispersed (but unequally so) among different communities and generations. It also differs from other instances of historical injustice in that the activity that constitutes the wrong (that is: emitting) is not something that is wrong *per se* (such as genocide or slavery), but rather is only wrongful when done excessively.

We propose to disentangle this combination of questions of intergenerational and global justice posed by climate change by splitting it up into the following parts:

1. What level of present emissions can be justified on a global scale? This is a question that we do not answer in this text. We simply presuppose that a justifiable global quota can be determined in some way (for plausible attempts at answering this question, see e.g. Caney (2006a) or Page (2006)). While considerations of self-interest, global justice and the significance of the relations between humans and the rest of nature may play a role in determining such a quota, we think that the consideration that yields the most stringent constraint on the size of the justifiable quota is intergenerational justice.

2. How should this global quota be split up among the present population of the planet? We aim at an answer to this question in sections 4.2 and 4.3. In section 4.2 we give an answer that does not take into account the history of past unequal emissions between the North and the South. Section 4.3 then adds these historical emissions to determine a more complete answer.

descendants of wronged persons because those descendants were wronged in that their parents did not receive the appropriate compensation and that as a result of this lack of payments the descendants are worse off than they would be if the compensation to their parents had been paid (after their conception); see Sher (2005) and Meyer (2008, sec. 5.1).

3. Who should pay for the damages that are caused by emissions, in particular assuming that people have not stayed and will not stay within their fair shares as determined in section 4.3? We aim at an answer to this question in section 4.4.

Question (ii) is concerned with how the mitigation burden should be distributed globally while question (iii) is concerned with how the adaptation burden should be distributed globally. In the policy arena and in the negotiation process these two issues will (and should) often be linked together. We only separate them here for analytical purposes. It also makes sense to hold the two issues of mitigation and adaptation initially apart, because distributing emission rights (the mitigation issue) seems to be an issue of pure distributive justice, while paying for the damage done by emissions (the adaptation issue) at first sight looks more like an issue of compensatory justice even if in the end we will conclude that the latter is mostly an issue of distributive justice as well.

A caveat at the start: we simplify strongly by always referring to the contrast between countries of the South and the North. The distinction between these two regions relies on the fact that there is a correlation – partly based on causal interdependencies – between (i) having emitted more in the past, (ii) having more benefits grounded in past emissions, (iii) being less vulnerable to climate change, and (iv) being wealthier in general.

Of course, the correlation is far from perfect. Even though we rely on the simplified perfect correlation for the purpose of our discussion, our argument becomes most relevant where the correlation is not perfect (e.g. a poor country with high past emissions or a wealthy country with high vulnerability). The reason is that any argument that ascribes higher duties to some regions than others will be based on one of the four features from above (higher past emissions, higher benefits from past emissions, lower vulnerability, or higher wealth). So if those features all coincide in the North there is not much to dispute since almost any argument will then ascribe higher duties to the North. In such a case, the sole purpose of the argu-

ment consists in the determination of the precise rationale for the duty of the North and its exact extent. Analyzing how exactly the higher duties of some countries are to be justified gains additional relevance, however, where features (i) – (iv) do not coincide.

In a longer treatment it would be tremendously worthwhile to apply the arguments not only to distinctions between the North, the South and countries with different combinations of features (i) – (iv) but also to socio-economic groups within countries and in particular to different individuals. Our real and ultimate interest lies in how emission rights and adaptation payments are distributed to *individuals*. When we speak of the North and the South we always implicitly either take those terms as an abbreviation for an individual of the North or the South or else we assume a two-stage-process where in a first stage climate justice between the countries of the North and the South is determined after which each country will then, in a second stage, internally distribute its mitigation and adaptation burdens fairly to individuals. Both assumptions are of course questionable. The first assumption – taking the terms "North" and "South" as abbreviations for the individuals living there – is most questionable concerning individuals who differ a lot from their compatriots concerning the above features (ii) – (iv), in particular with respect to wealth. The second assumption – that countries will internally justly distribute their climate duties – is of course questionable as well.[24] So, talking of the North and the South constitutes a real simplification.

Another complication that we bracket is the fact that the size of climate damages is not only determined by emissions. Responsibility for exposing people to climate damages lies also with those who contribute, possibly wrongfully, to vulnerability (where vulnerability is understood as the degree

[24] How do countries internally distribute the mitigation burden? Under the Kyoto Protocol emission quotas were handed out to countries that then had to decide how to reach their target. Practically, countries will reach their emission reduction targets by, for example, regulations, taxes, giving permits to firms for free or auctioning them (both with or without allowing trade of those permits) and buying emission reductions from other countries.

to which people are susceptible to suffer from and unable to cope with a given level of climate change). A fuller treatment of compensatory justice in climate change would have to include those who enhance vulnerability as possibly standing under a duty to pay and, where contributing to ones own vulnerability is at stake, as reducing their right to receive payments. Accounting for vulnerability creation, however, is a difficult matter: What level of enhancing vulnerability (or, respectively: what level of failing to engage in measures which decrease vulnerability) are sufficiently high so as to generate a compensatory duty? What kind of activities count as vulnerability creation – does any policy, for example, which limits economic growth qualify? We consider these intricate issues to be problems for another day and focus this chapter on emissions as the salient cause of climate damages.

4.2 Prioritarian Distribution of Emission Rights

In this section we will ask how emission rights should be split up among the present-day global population. We assume that some justifiable global quota has been determined which now must be dealt out to the countries on this planet. We are interested in a fair *initial* allocation of emission rights which may then be changed by subsequent trade.

Determining a fair distribution of emission rights is of high relevance in current climate policy. If the international community decides to cap total emissions then the emissions allowed under this cap *have* to be distributed in some way or other. As the right to emit was unlimited before a cap has turned it into a scarce good, there is no pre-existing default distribution of this asset on which one could fall back in case no distribution was agreed upon. In the Kyoto Protocol a cap was agreed on only for the industrialised countries, with the US ultimately not ratifying the agreement. In general, though, even with Kyoto enacted, the industrialised countries still have higher per capita emissions than the developing countries, which have no limits on emissions. The political philosopher interested in the pattern

according to which emissions were dealt out to industrialised nations under the Kyoto Protocol must be disappointed. The distribution was not based on the application of any clear-cut and explicit criterion of distributive justice but rather reflects political negotiation (cf. Depledge (2002, p. 37)) in that a strong element of grandfathering[25] is discernible (cf. Bartsch and Müller (2000, p. 227)).

4.2.1 The Good to Be Distributed and the Standard to Be Applied

We will judge the initial allocation of tradable emission rights according to prioritarian standards and we must be careful to state clearly what exactly *the good* is to which we apply these standards.[26] We will often use a rough shorthand and simply speak of distributing emissions while obviously

[25] In the context of the distribution of emission rights, grandfathering refers to the scheme that distributes emission rights according to past emissions: those with high levels of past emissions are granted high levels of current emission rights. The idea is sometimes implicit when the fairness of the distribution of emission rights is discussed in terms of percentage reductions or in the language of "burden sharing" (cf. Baer (2002, p. 395)). Grandfathering looms large in policy debates but this is not because of its moral appeal but rather because of its alignment with the interests of those with high bargaining power. If one were to try to defend grandfathering from a moral point of view in the sense of ascribing a right to the big polluters to keep up contributing a large share of global emissions one runs into difficulties as we have argued elsewhere (Meyer and Roser (2006, pp. 229ff.)). One could try to ascribe such a right on the basis of principles of just acquisition of previously unowned goods (such as the principles proposed by John Locke or Robert Nozick) or one could try to ascribe such a right on the basis of legitimate expectations. If such a strategy were successful – as we have argued it is not – the following section would, of course, not make sense. If polluters really were entitled to (a certain proportion of) the emissions level they have historically acquired then there would be no scope for distributing emissions according to some pattern such as the priority view.

[26] Some people speak of giving everyone a share of the atmosphere (Friends of the Earth (2006)) or a share of the climate (Christian Aid (1999)). This is less than precise since the issue is not "more or less atmosphere" or "more or less climate". Others speak of fairly distributing the absorptive capacity of the atmosphere (Neumayer (2000)). This is not the best description of the good in question either because the atmosphere can in principle take up huge amounts of greenhouse gases – almost unlimited amounts, or at least much more than we would want to allow under any plausible global cap on emissions. So, what is limited is not really the capacity of the atmosphere to absorb greenhouse gases but rather the willingness of humans to put up with the climate quality that would ensue from concentrations of greenhouse gases in the atmosphere above a certain level.

what is up for distribution are tradable emission *rights*[27] and not emissions themselves. The goods to which prioritarian standards are applied are, however, the *benefits*[28] that the use of emission rights makes possible and not the emission rights themselves. Emission rights are beneficial because they allow for what we call emission-generating activities such as producing industrial commodities, farming, or flying into vacation.[29] So, what the shorthand of "distributing emissions" ultimately amounts to is distributing (*by* distributing emission rights) the benefits of engaging in emission-generating activities. Or, *very* roughly but more intuitively, we could say that *by* distributing emission rights we are distributing economic progress – "very roughly", because, first, economic progress of course does not capture everything that is beneficial about emission-generating activities (sometimes economic progress is not even itself something beneficial), and, second, because there is no one-to-one relationship between emissions and economic progress as some draw much more economic output from the same amount of emissions than others.

The priority view differs from both egalitarianism and sufficientarianism. Egalitarianism is problematic because insofar as it views equality as an in-

[27] Also called "emission permits" or "emission allowances". On a more general level, note that the two main economic instruments to control emissions – cap-and-trade and a tax – are analytically and in their practical effects quite similar. Thus, many of our conclusions could also be applied to a regime that operated with a tax on emissions rather than a cap. It would however need a separate chapter to discuss which conclusions can precisely be transferred and which could not, depending on how the cap-and-trade policy and the tax would exactly be fleshed out.

Tradability of emission rights is also an important (and not uncontroversial) assumption because it allows those who have to reduce their emissions to do so at much lower cost and those who cannot make good use of their emission rights to turn them into cash. Because some degree of tradability will most certainly be part of any future climate policy and because we believe it to be morally defensible (see Meyer and Roser (2006, pp. 227f.)), assuming tradability is the more relevant case. Note that what we discuss is only the initial allocation of emission rights. This is what is of primary interest from a distributional point of view. The ensuing trade is mostly interesting from an efficiency perspective.

[28] We leave open what constitutes a benefit and the reader is free to insert something himself, such as quality of life, happiness, or capabilities.

[29] Besides this, emissions can also be beneficial in a different way, namely through the climate change they cause: selected people (e.g. some farmers in Northern latitudes) profit from a warming world.

trinsic value, it runs into the "levelling down objection": It has to admit that in *one* respect there is something better about a situation where everyone is equally badly off compared to a situation where some are badly off and some are well off. This reveals egalitarianism's principal concern to be comparative facts and not the absolute level of wellbeing of people. In reaction to this, sufficientarianism claims that what matters fundamentally is that everybody should have 'enough' and not equally much. While the position is not open to the levelling down objection, it is, to say the least, difficult to defend a strict threshold which is so important as to give people below it absolute priority over people above it (cf. Arneson (2000, p. 56) or Roemer (2004)). The priority view can be seen as aiming at taking into account the intuitions behind egalitarianism and sufficientarianism in the most plausible way (for a more extensive discussion see e.g. Holtug and Lippert-Rasmussen (2007), Meyer and Roser (2006), and Casal (2007)). It is the view that benefiting people matters regardless of how much others have but that we should give greater weight to benefits for people who are badly off than to benefits for people who are well off. Thus, in many cases the priority view will prescribe an equal distribution of the goods in question but it can also justify benefiting people unequally, namely to benefit those more who are badly off and to benefit those more who can draw more benefits from the good in question. It can thus be called a kind of non-relational egalitarianism or also a utilitarianism with a bias towards equality.

4.2.2 How to Apply the Priority View

We will proceed in two steps in order to determine a fair split of the global emissions quota. In the first step (section 4.2) we disregard the past. In the second step (section 4.3) we will take the large differences in historical emissions into account. Our argument will show in the first step that developing countries have a right to either equal or higher per capita emissions compared to developed countries. In the second step we will then argue that

taking the past into account strengthens the claim that developing countries should receive higher emission rights.

In the first step (that is, with past emissions blinded out) we have to make explicit how exactly we intend to apply prioritarian standards to the distribution of emission rights. We will present two options and generally rely on the first one for the reasons given below and also because the second option only strengthens, and in no way weakens, the general conclusion given by relying on the first option (which basically is that the South should get above average per capita emission rights). According to the first option we treat the fair distribution of emission rights as though the distribution of other goods was completely faded out from our view. According to the second option we take the currently existing highly unequal distribution of goods as given and distribute emission rights in light of it.

Both options are problematic. The problems of the first option are (i) that it abstracts in an unnatural way from the situation in the real world where the background distribution is hugely unequal and (ii) that if one applied this procedure of abstracting from the distribution of other goods to the distribution of every single good in the world one would not necessarily arrive at an overall distribution which would satisfy prioritarian standards since the different goods interact with each other in numerous ways relevant to the benefits people receive from having access to them; thus, following the first option generally is likely to produce unequal results for different people that do not accord to prioritarian standards. The problem with the second option – distributing emissions rights in light of the currently existing highly unequal distribution of other goods – is that it would yield a very simple answer: Give all the emission rights to the South. Following the second approach we would reach this conclusion regardless of whether we rely on the priority view, egalitarianism or utilitarianism[30]. However, it seems less than reasonable to aim at bringing the *overall* distribution

[30] For this to be true for utilitarianism we have to make the common assumption of diminishing marginal utility. For why the simple conclusion is true in the case of the priority view (or egalitarianism), see below.

of goods closer to the prioritarian (or egalitarian or utilitarian) ideal by adjusting the distribution of only *one* particular good.[31] This is particularly so, if considerations of distributive justice concerning the overall distribution of resources play a minor role in current politics while such considerations do play a considerable role concerning the specific good of emission rights.

Since both options are shown to be problematic, it is not at all straightforward how to apply the priority view to the distribution of a single good. This could be called a problem of "local justice,"[32] that is, a problem of the just distribution of a certain slice (here: emission rights) of the whole universe of goods. One might want to respond to the problem by denying that we can meaningfully ask how a certain single resource should be distributed; instead, questions of distributive justice can only meaningfully be raised concerning a whole bundle of goods such as, say, natural resources or primary goods (or even: only about all goods taken together; or even stronger: only about the design of institutions affecting the distribution of those goods). However, we are faced with such problems of fair distribution of certain specific goods in our non-ideal world. As theoreticians we might want to restrict ourselves to answering the more general questions of ideal theory,[33] but answers to them will not by themselves provide us with answers to those questions that political reality hands to us. Currently, it is

[31] A further complicating aspect of taking the second approach is this: One could also take into account the effect the principle for the distribution of emission rights has on the availability and distribution of other goods. Such effects can take the form of the worry that distributing emission quotas to countries according to their population (that is, per capita emission rights) could incentivise population growth (which is not a grave worry, see Baer (2002, fn. 17)) or the form of the worry that too abrupt a change from the current pattern of distribution could cause a perturbation of the world economy to the detriment of everyone. It can also take the opposite form of the hope that when the principle for distributing emissions consists in adjusting the quota according to the GDP of a country (Bush's intensity approach) this would yield incentives for more emission efficient production, and, in allowing emissions to rise with output, would not hamper economic growth. Such growth might ultimately benefit everyone, including those who initially get few emission rights in such a scheme where emission quotas are proportional to GDP (for a critical discussion of this argument, see Singer (2002, pp. 38–40)).

[32] See Gosseries' (2004, 2007) remarks on this issue. He relies on Elster (1992).

[33] See also Rawls' remarks (1971, p. 8) on starting with more tractable questions by limiting the subject matter of his investigation.

not an issue of much political relevance of how to globally distribute, say, *all* natural resources (or *all* goods in general) but the issue of how to distribute emission rights is one which is high on the agenda; given that a cap on emissions is set we *cannot* even escape distributing them in some way or other. By setting a cap, a good that earlier was available in unlimited quantities has suddenly been turned into a scarce good and, thus, we are confronted with the question of how to distribute this newly created good worth billions of dollars. We hope to show that from the point of view of principles of justice there is *something* to be said about the distribution of this specific good even though such good-specific questions of "local justice" do not belong to the questions that normative theorists are most used to answering.[34]

4.2.3 The Priority View and Emission Rights

So, what would the first option – that is, abstracting from the existing background distribution of other goods – demand concerning the distribution of emission rights? It would simply demand an equal per capita distribution of these rights. The priority view has a justification for the unequal distribution of a fixed amount of a good in two cases only: first, if some of the recipients are worse off than others; second, if some of the recipients can extract more benefits out of the particular good than others.[35] Both justifications are excluded by the assumption that the background assumption is not taken into account. For the second justification this is true because how many benefits individuals can draw from an emission right depends on the endowments of other goods such as wealth, the natural environment, or the

[34] Gosseries (2004, p. 51) notes, however, how we are used to such good-specific or sector-specific thinking concerning distribution in practice: Even though a country might have a general redistributive scheme, it might still keep up sector-specific redistributive measures such as cheaper tickets for senior citizens for public transport.

[35] A third legitimate reason for inequality arises once the free choices of individuals are taken into account. The priority view can take them into account by catering to the idea of responsibility, that is, respecting the value of free choice even if this should mess up the optimal prioritarian distribution.

industrial structure of one's country. Thus, with the background distribution regarded as irrelevant, the priority view would demand a distribution of equal per capita emission rights.

The two justifications for inequality in prioritiarianism do apply, however, if we go for the second option (that is, assuming the presently existing global distribution of goods as background). The first justification clearly applies: The South is much less well off than the North. It is so much less well off that we could give *all* emission rights to the South and it would still – even with all the cash the South could generate from selling these emission rights – be overall and for the foreseeable future worse off than the North.[36] Thus, the priority view demands giving all emission rights to the South.

The second prioritarian justification for an unequal distribution of a particular good – that is, that some can draw more benefits from the good – is also relevant. One can cite various aspects which have an influence on how useful an emission right is to someone:

1. Geographical factors make some people more reliant on emissions, e.g. because they need to heat their houses a lot in the winter.

2. Another factor is wealth; according to the hypothesis of diminishing marginal utility, one and the same good is deemed more valuable in the hands of a poor person than a wealthy person: "Subsistence emissions" are more important than "luxury emissions" (cf. Shue (1993)). However, at least as a matter of transitory justice, one has to take

[36] This claim is mainly backed up by the thought that while the global total of emission rights under a cap which sets the limit below business-as-usual emissions might be of tremendous economic value, emission rights are still only one good among many. With a back-of-the-envelope-calculation: Even if we inserted large values and assumed that 7 billion people with a right to per capita emissions of 10 tons yearly would trade these emissions at $100 per ton, the total value of these emission rights would still only be a fraction of the gap in GNI between high income countries on the one hand and low and middle income countries on the other hand (according to the World Bank (2008, Table 1.1) this gap was around $27 trillion or, based on Purchasing Power Parity, $12 trillion in 2006). In per capita terms it would be even clearer.

into account that given that people in the North are so accustomed to an energy intensive lifestyle there is also a reason to say that emission rights are in one respect more valuable for rich people than poor people. See also fn. 41 below.

3. Another factor that might be cited as revealing the higher utility of emission rights for some countries than others is emission intensity, that is, the amount of emissions per GDP. Countries with low emission intensity produce a lot of GDP per emission and thus, according to the prioritarian logic, they might claim a high share of emission rights.[37] However, what really counts is the emission intensity *at the margin*, that is, how much GDP could be produced with an *additional* unit of emission. At the margin, even a country which in the global division of labour hosts many industry branches with a high emission intensity and thus has a high *overall* emission intensity might not do badly.

All things considered this second prioritarian justification for inequality (appealing to the unequal benefit that different individuals draw from a particular good) gives us a rather blurry picture and so, one conclusion we can definitely draw is that it does not support giving the North above average emission rights. Even if some tendency as to whether it is the South or the North which profits more from an emission right could be determined, one would have to take into account that such a tendency would be watered down significantly under the assumption of emissions trade. If we assume the tradability of emission rights, the scope for unequal benefiting from emissions is drastically reduced because those who profit little from emission rights can simply turn them into money.

[37] Interestingly, there is no very clear picture concerning the connection between the wealth and the emission intensity of a country. Developed countries do not have a lower carbon dioxide emission intensity. They do have a lower emission intensity when all greenhouse gases are taken into account. But even in the latter case there are many exceptions with Australia for example having a much higher emission intensity than Brazil (Baumert and Pershing (2005, pp. 25f.)).

So we may safely conclude – and this is taking into account all of the above discussed considerations but not considering past emissions – that the priority view demands at least *equal* per capita emission rights or else *more* (or possibly: *all*) emission rights for the South. Since other considerations[38] in this chapter will lead us to argue for higher than equal per capita emission rights for the South and because in current climate negotiations it is no option anyway to give higher emission rights to the South, we will, in the following parts of the chapter, rely on the minimal conclusion of the first option that the priority view without taking the past into account speaks in favor of equal per capita emission rights.

The following table the discussion in section 4.3 thus far.

	First justification for inequality: Some recipients are worse off than others	Second justification for inequality: Some recipients can draw more benefits from emission rights than others	Conclusion
Option 1: Abstracting from the background distribution of other goods	Does not apply in case of Option 1	Does not apply in case of Option 1	Equal per capita emission rights
Option 2: Taking into account the currently existing inequality in the distribution of other goods	Speaks in favour of more or all emission rights for the South	Difficult to extract a clear picture based on such potential factors as needs due to geographical circumstances, wealth, or emission intensity. In case of tradability this justification loses much of its relevance.	Higher per capita emission rights for the South

[38] Note that these other considerations partly amount to taking into account the background distribution of other goods (as demanded by the second option). They do so in a certain way, however: It will only be the inequality of benefits associated with past emissions which is taken into account (or possibly, as indicated in the conclusion, also the inequality in climate damages) and not the whole inequality in the background distribution.

4.3 Currently Living People Benefiting from Past Emissions

In a second step we will now examine how we will have to amend this answer when we take the past into account. We will argue that the higher historical emissions of the North give us reasons to tilt the allocation of emission rights in favour of the South.

The difference in historical emissions between the North and the South is far from negligible. Developed countries are responsible for more than three times as many emissions between 1850 and 2002 than developing countries (Baumert and Pershing (2005, p. 32)) while the latter host a much larger part of humanity. In the policy arena a counterbalance to the historical inequality in emissions was most prominently discussed under the heading of the "Brazilian Proposal" (for an overview see La Rovere et al. (2002)). The Brazilian Proposal received little support. More generally, there is quite some resistance to counterbalancing past emissions. Important objections include the following:[39]

1. A first objection states that currently living people should not be made responsible for the acts of their ancestors and should not be put at a disadvantage simply because the people inhabiting their country before them emitted too much.

2. A second objection states that one can only be blamed for a certain act if one knows – or is liable to know – of the harmful effects of the act whereas it is debatable whether until recently knowledge of the harmful effect of emissions was sufficiently widespread.

3. A third objection points to the relevance of the non-identity problem; no one can claim to be worse off or better off than she would be had

[39] In addition to these three points there are also practical difficulties: First, of estimating past emissions and, second, of bringing it into the negotiating process because it is neither a simple (but rather a complex) proposal nor is it one which serves the interests of those with the highest bargaining power.

another climate policy been pursued in the sufficiently distant past.

Note that each of the objections attacks emissions behind a different date of the past. The first one concerns emissions by people who are now dead, the second emissions, say, before the first IPCC report in 1990,[40] and the third emissions (and policies influencing emissions) so early as to be a determining factor of the number and identity of people living today.

4.3.1 Two Ways in Which Past Emissions Are Relevant

There are, however, two ways of taking past emissions into account (more precisely: taking *part of* past emissions into account) that are not susceptible to the three objections. The first way turns on what we consider the relevant units of concern and, in particular, what temporal extension they have. If as prioritarians we demand equality of emission benefits, do we demand equality at each point in time or equality over the whole lifespan of individuals? If we go for the latter option (which is the more plausible for the majority of egalitarians according to Holtug and Lippert-Rasmussen (2007, p. 10)) then one part of past emissions enters very naturally into the fair deal concerning the present distribution of emission rights; namely, the emissions that occurred during the life of the presently living. The simple idea is that people of the North already enjoyed much economic progress associated with emissions during their lifetime: if we want to equalise the benefits from emission-generating activities then a larger part of the remaining benefits should go to people in the South so they have the opportunity to "catch up". This is one way (the first of two) of arguing for above average per capita emission rights for the South.

The first and third objections obviously do not speak against this way of taking past emissions into account. What about the second objection,

[40] Gosseries (2004) lists some salient dates which might serve as an alternative to 1990: 1840 (as proposed by the Brazilian Proposal), 1896 (first scientific text on the greenhouse effect by Svante Arrhenius), 1967 (first serious modelling exercises), and 1995 (second IPCC report). One might also add the IPCC reports from 2001 and 2007 as well as the very beginning of industrialisation in the 18th century.

that is, the claim that the ignorance of past polluters does not allow the attribution of responsibility for those emissions to them? It has no bite either. The reason is that the above argument does not justify higher emission rights for the South as compensation for past wrongdoing of the North. It justifies them by the idea of equalising emission benefits over the lifetime of individuals. If an individual of the North already has used up his share, it does not matter whether he did so knowingly and wrongfully or not.[41]

The second justifiable way of taking past emissions into account for the determination of the presently fair shares relies on the fact that we do not want to equalise *emissions* but rather *benefits of emissions*. And since the industrialisation of the ancestors of the people currently living in the North yields benefits up to today and much more so for people of the North than the South, this has to be taken into account even if the emissions were caused by people who are now dead. Benefits from past emissions include, for example, schools and streets that were built before those presently alive were born but that are still useful today.

The first two objections obviously do not speak against this way of taking past emissions into account. The third objection (the non-identity problem) has no bite either: We do not claim that people of the South are worse off than they would be without emissions in the distant past and neither do we claim that people of the North benefit from industrialisation in the distant past in the sense of being better off than they would be had there been no industrialisation. They only benefit in the sense that since their conception they enjoy being brought up in an industrialised world while others cannot enjoy such circumstances. To illustrate, if an inhabitant of the North had been taken after his birth and had been transferred to a slum

[41] This approximate conclusion has to be qualified somewhat as a matter of transitory justice (cf. Gosseries (2007)): If people were legitimately ignorant about the problematic nature of their emissions then some legitimate expectations accompany the ownership of their emission benefits. This is the case, for example, if they made investments on the basis of the belief that they would be able to keep up their emission levels. If one cut emission rights of people in the North too abruptly they would actually end up not with equal overall emission benefits as people in the South but rather – due to the disruption of their life plans – worse off.

in the South, he would be worse off than he would be had he been raised in the developed world. Due to the non-identity problem it is still true, however, that if he is not transferred he cannot claim to be better off than he would be without industrialisation, since if a different economic development path had been pursued, most likely, he would not exist today. But what is true is that due to past economic policies and the emissions accompanying them the benefits of living in an economically developed world have been bequeathed to some currently living people since their conception but not to others. So, if there is at present more "economic progress to be given away" (that is: emission rights to be distributed which allow for the emissions that accompany economic progress), and if we want to give everyone an equal share of economic progress – taken here as the main benefit associated with emissions – people of the South should get a disproportionate share of emission rights because people of the North have already received a large part of their share by inheritance from their ancestors.

Against this second way of taking the past into account it might be objected that it is questionable whether the receipt of benefits generates any obligations at all. This is even more debatable if the benefits were "imposed" rather than voluntarily accepted, as is the case with being born into an industrialised world. The answer to this worry is that the second way of taking past emissions into account does *not* rely on the premise that inheriting emission benefits generates obligations to give something to others *in turn*. The argument only presupposes is that those who were born with a large "slice of the pie" have a smaller claim when it comes to splitting up the rest of the pie.

4.3.2 Why the Objections Are Irrelevant

So, our conclusion is that based on the unequal benefits enjoyed by people in the North and the South certain parts of past emissions should be taken into account for the purpose of distributing emissions rights today; namely, those past emissions that occurred during the lifetime of the presently living

and those past emissions that were side products of benefits which are still around today.[42] Not all inequality in historical emissions should be taken into account, however; those emissions that belonged to people who are now dead and which yield no benefits for the currently living should be written off.

We can now look at the general reason why the three objections do not pose any problem for our two ways of taking past emissions into account. All three objections rely on the idea that lower than equal shares of emission rights for the North must be grounded in the idea of compensation, that is, the idea that the wrongdoer (or the beneficiary of a wrongful action) must return something to those who are harmed. The idea of compensation is present in the three objections as follows. The third objection (the non-identity problem) denies that past emissions can be seen as harmful (or beneficial) and, so, if there is no harming (or benefitting), then no compensation is appropriate. It also denies that some are made better off through emissions than they would otherwise be and so there is no beneficiary. The second objection (ignorance about the climate problem) claims that even if past emissions could be seen as harmful, they still cannot be seen as wrongful; as such, no compensation is owed. The first objection (being responsible for ones ancestors deeds) goes further in stating that even if past emissions were both harmful and wrongful, still, compensation is not owed, reason being that compensation is something that the wrongdoer himself must pay and not his descendants.

Even if the objections were based on sound premises when applied to other positions,[43] they have no bite against our argument since our two ways of taking past emissions into account in no way rely on the idea of compensation for past wrongs. They consider the distribution of emission

[42] Caney (2006b) argues that evening out inequalities in emissions over time relies on a collectivist framework. Note that by focusing on the benefits of past emissions enjoyed by the presently living, we can eschew this problem.

[43] We do not believe that the objections are wholly based on sound premises; see e.g. the discussion of the non-identity problem in Meyer (2008, sec. 3.1) and the discussion of the Community Pays Principle in section 4.4.

rights as a problem of pure distributive justice without any reference to harm or wrong.[44] The idea is simply to distribute the benefits associated with emission-generating activities equally among the presently living – and in order to achieve this goal it is necessary to give people of the South higher shares of emission rights.

This is not to say that the three objections are not important. They are important when it comes to a different question: Not the question of how to distribute the benefits of emission-generating activities fairly but rather the question of how to deal with the bad *consequences* of emission-generating activities fairly. Concerning this latter question – that is, justice concerning the climate change that is caused by industrialisation – the three objections are relevant, indeed. This question will be taken up in section 4.4. In this section we assumed climate damages to be an issue that can be separated from the issue of a fair distribution of emission rights.

4.3.3 A Numerical Illustration

To make the point of this section and in particular the point of the next section comprehensible we will present the basic idea in a simple numerical illustration. Assume that we have two islands called "North" and "South". Both islands consist of three persons: "Old", "Middle", and "Young". On both islands, Young is born after the death of Old. We have two time-periods: period I and II.

The question is: Presupposing the emissions of period I, how should emission rights be distributed in period II among the North and the South? We assume that each island is able and willing to fairly distribute its emission

[44] Note also that there is something peculiar about seeing mitigation as a kind of compensation for not mitigating: It can only be applied in the sense of seeing present mitigation as compensation for past lack of mitigation but of course not in the synchronic fashion of seeing present mitigation as compensation for a lack of present mitigation. This is in contrast to paying for adaptation costs, which can be seen as compensation for a lack of present mitigation.

rights internally.[45] An important assumption is that 2 units of emissions in the North in period I create 2 units of benefit for the North in period I, and 1 unit of benefit for the North in period II (assume for example that the 2 units of emission were used in period I for (i) an airplane flight into vacation and (ii) the building of a school: The airplane flight is beneficial only at the time of the emission while the school building yields a benefit in both periods). The same applies to the South. We assume that the South emitted 8 units in period I and the North emitted 12 units in period I.

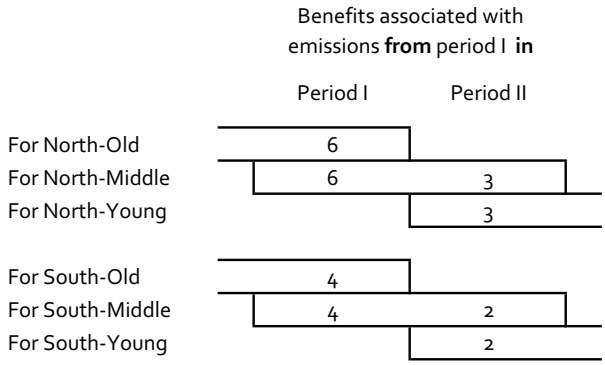

Figure 5

Let us say that there are 10 units of emissions to be distributed in period II. How many should the North get and how many should the South get according to our reasoning? People in the North alive in period II already own 12 emission benefits. 6 of those 12 benefits are those that North-Middle enjoyed in period I (our first way of taking the past into account) and the other 6 benefits are those that North-Middle and North-Young enjoy in period II as a result of the Northern emissions in period I (our second way of taking the past into account). People in the South alive in period II in

[45] Later on we add compensation payments to the discussion. Of course, we assume that they distribute these internally fairly as well.

contrast only own 8 emission benefits (4+2 from South-Middle and 2 from South-Young).

So, our argument says that of the 10 emission benefits to be distributed, the North should get 3 (together with its 12 benefits this sums up to 15) and the South should get 7 (together with its 8 benefits this sums up to 15 as well). Given that these emission rights are fairly distributed internally within each island,[46] distributive justice among the people alive in period II is created in such a way. Not all past emissions have been taken into account: The inequality of emissions benefits between North-Old and South-Old in period I will forever remain without relevance. But a large part of historical emissions *is* deemed relevant for the present allocation of emission rights.

What would this mean in practice for a Post-Kyoto treaty? Enacting the fair solution demands allocating a share of emissions to each country that is either above or below the equal-per-capita share depending on whether the country has a lot or few benefits from past emissions. Countries then have to see to it that they internally distribute the mitigation burden fairly, which amounts to disproportionately burdening those citizens who already own many emission benefits. This can probably not be approximated more accurately than by each citizen's wealth.

At the country level, however, benefits from past emissions can not only be approximated by the country's wealth but also by a measure which adds up cumulative past emissions of a given country but discounts those emissions according to how far in the past they lie. The idea of such discounting is that emissions closer to the present yield more benefits for the presently living. Relying on such a measure as an approximation for benefits from past emissions instead of relying on wealth as an approximation amounts to either assuming that the current inhabitants of each country should be made responsible for how many benefits are drawn from a given amount of emissions in the past or else to make the simplifying assumption that every-

[46] North-Young could blame North-Middle for emitting so much in period I as a result of which the whole North gets few emission rights in period II. North-Young might punish North-Middle for this by, for example, cutting its social security.

one draws the same amount of benefits from a given amount of emissions. It also leaves open whether wealth is a good specification of what constitutes benefits from emission generating activities.

Note that these ways of taking past emissions into account for the specification of the distribution of the mitigation burden are similar to but distinct from the Brazilian Proposal. The latter is the most prominent suggestion for taking past emissions into account. However, in its calculations it relied on the cumulative effect of emissions since 1840 on global average surface temperature, that is, it discounted past emissions not according to how many benefits they yield today but according to how much damage they do.

4.4 Who Must Pay for Climate Damages?

The last section discussed a fair deal concerning emissions as the *cause* of climate change and this section discusses a fair deal concerning climate change as the *effect* of these emissions, both with a special eye towards the relevance of the past. If global climate policy negotiations are guided by power and self-interest the South will lose on both issues: it will not only be treated unfairly in the realm of the distribution of emissions but also in the realm of the distribution of costs that arise out of these emissions.

These costs have two aspects: First, the climate damages themselves, and second – since the impact of emissions not only depends on the level of climate change produced by them, but also in the human reaction to this change – the adaptation costs necessary to minimise or at least decrease this impact. In this section our ultimate concern is justice concerning all costs – i.e. the adaptation costs *plus* the damages that remain even after optimal adaptation. But: since the damages themselves cannot be transferred from one person to another, justice concerning the whole costs of climate change will have to be reached by taking only the *one* aspect of who is responsible for adaptation costs as a variable under control of policy.

The issue of injustice concerning climate damages arises on two levels. First, the South will be hit harder by climate change. This is so independently of how much climate change occurs and who is causally responsible for it. It is likewise so even if only non-anthropogenic climate change occurred or if everybody in the past had stuck to their fair share of emissions. The most important reasons for the higher vulnerability of the South are geographical factors, the higher reliance on agriculture and the lower adaptive capacities. Second, and independently of the first point, it is the case that people have exceeded and predictably will exceed their fair shares as determined in the last section. In any realistic scenario the North will have exceeded its share, and will have done so more than the South. In any case, we will presuppose that this is so in this section.

How should climate damages, and in particular the fact that the South will be particularly vulnerable to climate change while at the same time being causally less responsible for it, be dealt with from the point of view of justice? One answer that quickly comes to mind is that the South is owed compensation for its suffering and that the North as the main culprit for climate change should provide sufficient measures of compensation. This section will point out the problems of this view and suggest to view climate damages primarily as a reason for redistribution due to undeserved benefits and harms rather than as a reason for compensation due to wrongdoing.

4.4.1 Distributive and Compensatory Justice

To argue for this conclusion we will first discuss compensation (in three versions) and then redistribution. We have to make clear exactly what kind of compensation and redistribution we are interested in.

One way to make the distinction between the basic idea of redistribution and compensation starts with the premise that there is some *baseline distribution* of goods that is just. This baseline distribution is determined on the

one hand by a certain criterion (such as the priority view, egalitarianism, or sufficientarianism or possibly even simply the status quo distribution) and on the other hand by changes to the distribution which someone experiences as a result of his own *responsible (and non-wrongful) choices*. Deviations from this baseline then call for two different kinds of reactions. In case the reaction the deviation calls for is *based on the wrongfulness* of what occurred, we are operating in the realm of *compensatory justice*. In case the reaction the deviation calls for is based on the idea of *evening out undeserved* benefits or harms (which are due to for example luck or harmful but non-wrongful actions), we are operating in the realm of *distributive justice*.

This is the kind of distinction between distributive and compensatory justice that we will make use of. The basic idea is to ask: which duties to pay for adaptation to climate change rely for their justification on the wrongfulness of what was done, i.e. which duties can be traced back to the compensatory rationale? Any duties that cannot be so traced back will fall into the category of the redistributive rationale and will be regarded as grounded in the objective of levelling off undeserved benefits and harms. Whether payments for adaptation costs are justified on the basis of the compensatory or redistributive rationale also determines the size of such payments.

Two remarks are appropriate: First, not everybody regards evening out undeserved benefits and harms through redistribution as a moral imperative (see e.g. Cane (1993, p. 355)); and some, namely sufficientarians, regard it as an imperative only up to the point where everybody has "enough". We will assume that undeserved benefits and harms should be evened out according to prioritarian standards, but we believe that the basic point of distinguishing compensatory and redistributive rationales remains interesting also for theorists who do not see undeserved benefits and harms as giving weighty reasons for redistribution.

Second, note that we are operating with a narrow notion of compensa-

tion which is not completely in line with the way the terminology is used in other contexts where the notion is also used for payments which are due to non-wrongful harm-doing. An example of this use is given by Feinberg (1978): A backpacker is surprised by an unexpected blizzard and breaks into a mountain cabin, eating food there and burning furniture to protect himself from the cold. He was surely justified in doing this to save himself and thus he wasn't wrongful in harming the owner of the hut, but he owes compensation to the latter anyway. We surely agree that wrongfulness is not a necessary condition for justifying payments, whether or not such payments are labelled compensatory payments. All we argue for is that it is an interesting question in the intergenerational context of climate change to separate payments based on wrongfulness from those not based on wrongfulness and that the latter can be seen as based on other (namely, redistributive) concerns than the former. Note that, in principle, the justifiable payments of the backpacker to the owner of the hut could also ultimately be seen as grounded in the redistributive concern of levelling off undeserved deviations: the owner suffers from undeserved harms while the backpacker has benefitted from using the hut. It could be claimed that, ultimately, the justification for demanding payments from the latter consists in evening out such undeserved harms and benefits.[47] At least, that is how we will treat non-wrongful harm-doing in the intergenerational context of climate change.

We will distinguish three versions of compensatory payments depending on who has the duty to come up with them.[48] The most natural duty bearer for compensatory payments is the emitter of wrongful emissions himself. We call this the *Emitter Pays Principle* (EmPP). Such compensation can also

[47] Indeed, even theorists who see no reason for levelling off good and bad luck in general, might see some reason to do so in the case of benefits and harms which are due to non-wrongful harm-doing.

[48] These distinctions and the discussion of problems associated with each principle in the context of climate change justice have been most helpfully introduced and discussed by Simon Caney (2005, 2006b) and Axel Gosseries (2004). In many ways our argument in this section is indebted to their interpretations and analyses.

be labelled restitution. Restitution is characterised by the wrongdoer restituting the good – if possible in kind[49] – to the wronged person. This serves the aim of restoring the moral relationship between the wrongdoer and the wronged person (cf. Meyer (2005, p. 228)). A second version of compensatory payments identifies the beneficiary of wrongful emissions as responsible for providing compensation: the *Beneficiary Pays Principle* (BePP). A third version ascribes the duty to pay compensation to the wrongdoing community: the *Community Pays Principle* (CoPP). The expression of a "wrongdoing and compensating community" is somewhat misleading in that we do not want to postulate a collective agent. In this text we presuppose normative individualism.[50] The convenient shorthand of "a community having the duty to pay compensation for its wrongdoing" stands for: some *individuals* have a duty to pay compensation due to their membership in a community of which (they or) some other individual members committed wrongs.

In discussing these three principles, we will have to answer two questions in turn for each principle: How plausible is it as a principle of compensatory justice in general? And: what kind of compensatory measures can it justify in the climate change context?

In order to illustrate more easily why compensatory measures are difficult to justify we will make use of the numerical example from the last section again. For this section, we add the assumption that the emissions from period I cause climate damages in period II, say 5 for people in the North and 10 for people in the South. We use this example to illustrate the arguments against the view that the provision of compensatory measures is the most adequate response to climate damages.

[49] Since in our case the good in question is climate quality, restitution in kind is difficult to imagine.

[50] Normative individualism implies that, strictly speaking and at least in a non-derivative sense, only individuals and not communities act, have rights and duties, can be benefited, etc.

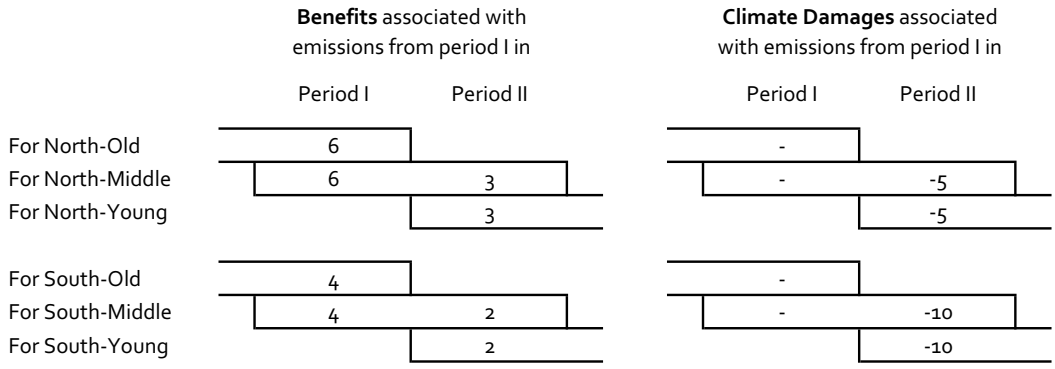

Figure 6

4.4.2 Compensatory Payments for Climate Damages

There are six basic problems for justifying compensatory payments in the context of climate damages:[51]

1. Potential payers might be dead.[52]

2. Potential payers might not have exceeded their fair shares.

3. Potential payers might have been (blamelessly) ignorant.

4. Potential recipients might (due to the non-identity problem) only be said to be harmed according to a threshold conception of harm.[53]

[51] In section 4.3 we already mentioned the most important of these six problems when we sketched the three objections to taking historical emissions into account for the purpose of determining a just distribution of emission rights.

[52] By potential payers we mean people who were either causally responsible for climate change or who are placed into beneficial circumstances that are partly due to emission-generating activities. By potential recipients we mean people who are placed into living conditions which would be more favourable if it were not for climate change.

[53] The non-identity problem precludes us from saying that future people are harmed (or benefited) by actions that are necessary conditions of their existence (cf. Parfit (1984)). This is so if we understand harm in the sense of being made worse off by an action than one would otherwise be. There is however another conception of harm which successfully evades the non-identity problem: By claiming that people

5. Potential payers might (due to the non-identity problem) not be said to have benefited.

6. Potential recipients might not be wrongfully harmed because climate change may also have non-anthropogenic sources.

First let us look at the principle that demands that the emitter must pay compensation for his wrongful emissions to those who are wronged (EmPP). There is not much doubt that in general (that is, disregarding whether it can usefully be applied to the climate change problem) the idea of such compensation is very well supported by our moral intuitions.[54] This is in

can be said to be harmed by actions which make them fall below a certain prespecified threshold, future people can also be said to be harmed by actions which are a necessary condition of their existence. For a treatment of these issues, see Meyer and Roser (2008).

[54] Note that we distinguish this principle from "polluter pays principles" (or also "strict liability principles") by focusing only on wrongful emitters while the polluter pays principle or a strict liability principle or also Moellendorf's (2002, p. 98) causal principle make any emitter – whether wrongful or not – pay. Such principles, which make people pay who are causally responsible for emissions irrespective of their culpability, can obviously not serve as principles of compensatory justice in the narrow sense defined above. This is however not to say, that in practice policies relying on such a polluter pays principle could never be justified for certain areas of environmental policy. It can legitimately be put into practice for three reasons:

(i) In practice, in some areas of environmental policy it might be difficult to hold wrongful and non-wrongful emitters apart; or the two categories might overlap to such a large degree that it would be too cumbersome to hold them apart. Thus, enacting a polluter pays principle might serve as an approximation for the policy which demands compensation from wrongdoers.

(ii) The policy might also serve as an approximation for a policy based on the redistributive rationale: Because polluters often benefit from their polluting action, making them pay something to the harmed can be seen as evening out undeserved deviations from a just baseline.

(iii) A third and completely unrelated justification is based on instrumental grounds in the following way: Making people pay for harmful activities sets the right incentives from an economic perspective and thus generates efficiency. If emitters (who are assumed to act self-interestedly as *homines oeconomici*) have to bear the external costs that appear as side-effects of their actions they will only perform an emitting action in case the benefits exceed the costs. Thus, in a society where emitters (whether wrongful or not) are made to pay, all and only those emitting actions will be performed that have a net benefit which brings forth efficiency. However, such an instrumental justification for making emitters pay has no necessary link to the idea of compensatory or redistributive justice. This can also be seen by noting that such an instrumental justification in fact provides no rationale at all for why the emitters' payments should be handed over to the people harmed by the emissions. The principle's whole idea is to deter people from emitting on a

contrast to BePP and CoPP where the principle itself – even apart from its application to the climate change problem – is in need of some supporting arguments. The only dispute in the case of EmPP is whether it can justify compensatory payments for the specific case of climate damages or not.

If EmPP is put to the service of justifying compensatory payments one has to identify wrongful emitters and wrongfully harmed persons. Someone emits wrongfully if (i) he exceeded his fair share and (ii) he knew or was liable to know about the harmfulness of his emissions. Someone is wrongfully harmed by emissions if he either is worse off due to wrongful emissions than he would otherwise be or falls below the specified threshold of harm due to the wrongful emissions (or both) (see fn. 53). Let us use the numerical example to look at what duties to pay compensation and what rights to receive compensation the EmPP can and cannot justify in period II:

1. North-Old and South-Old cannot have a duty to pay compensation because they are dead.

2. South-Middle (as well as South-Old) did not exceed its fair share and so must not pay.

3. North-Middle (as well as the other emitters from period I) might not have been aware, and might neither have been liable to be aware, of the problematic nature of its emissions and thus it can be excused by ignorance of wrongdoing.[55]

4. North-Young and South-Young can only claim to be wronged – and claim with it a right to compensation – if they fall below the threshold as specified by the threshold conception of harm. They cannot be said to be harmed simply because climate quality is worse than it would be had there been less emissions in period I.

non-optimal level by making them pay.

[55] See fn. 40 for some plausible dates behind which one could claim to have been blamelessly ignorant.

So, if one could legitimately be excused by ignorance in period I, then EmPP cannot identify *any* wrongful emitter at all to pay compensation payments. If not, it can still only ascribe compensatory duties to North-Middle (even though it is only one of four agents causally responsible for climate change in period II). EmPP also has some trouble in identifying wronged agents: In contrast to South-Middle (and North-Middle), South-Young (and North-Young) can only be said to be wronged – and thus be the rightful recipient of compensatory payments – if they fall below the relevant threshold.

Of course, some assumptions that we made in the numerical model might be loosened and then some duty bearers or right bearers might be identified. The assumptions could be relaxed in the following directions: First, period I could be defined as being at a point of time when the excuse from ignorance has no more force. Second, damages could be modelled as starting to materialise immediately after the emissions were produced and not only in the next period. Third, also the South might exceed its fair share. Fourth, the relevance of the non-identity problem could be less stressed. Our purpose in making these strict assumptions, though, was to highlight all the problems that potentially come up when one makes an attempt at justifying compensatory payments based on EmPP.

Let us turn to the principle that demands that those who have *benefited* from wrongful emissions must pay compensation (BePP). First we have to ask whether it is a legitimate principle in general, that is, apart from the climate change question, to make the reception of benefits from a wrong imply the reception of duties of compensation. Applied to the issue of climate damages the question is the following: Why should people who have committed no wrongful emissions but have only benefited (either from emission-generating activities or from climate change itself) have to pay compensation? Does this not go against the spirit of our definition of compensatory payments as being grounded in a wrong? Note that the peo-

ple who received benefits from past emission-generating activities without engaging in emission-generating activities themselves did not ask for these benefits; they were imposed on them, so to speak.

There is no completely obvious answer to the question of whether benefiting from wrongdoing creates a duty of compensation. The difficulty of judging this issue is based on two reasons. First, if one was benefited by a wrong then the benefit is most definitely not *deserved*. It is deserved as little as any other benefit one receives by luck (if anything, it is deserved even less).[56] And based on considerations of distributive justice one can see *any* undeserved benefit (and harm) as calling for redistribution regardless of whether one received this benefit due to a wrongful action or brute luck. But what we are asking in discussing the BePP is whether the reception of benefits from a wrong implies a duty of *compensation* (that is, a duty which for its justification presupposes the wrongness of the action) and not whether it creates a duty of redistribution. The second reason why it is difficult to judge the BePP as a principle of compensatory justice is that in our daily lives we are not used to think about cases where the people who commit the wrong do not coincide with the people who benefit from the wrong (cf. Anwander (2005, p. 40)). But here our question is whether benefiting from a wrong gives reason to compensate *independently* from having contributed to the wrong.

Still, the BePP has to be judged even if it is difficult. On the one hand, there are clear examples where we do not judge benefiting from an injustice as calling for compensation. Note for example that everybody who uses an X-ray profits from how this technology was refined using data from Hiroshima (see Anwander (2005, p. 40)). On the other hand, there are intuitions to the contrary. Gosseries (2004), for example, enables us to see benefiting from an action without paying the associated costs in the light of the notion

[56] Note though, that in our non-ideal world, it is often possible that by accident benefits from wrongdoing bring an individual who doesn't get the goods he or she deserves in the real world closer to the level of wellbeing he or she were at in the ideally just state of affairs.

of free-riding. Present-day inhabitants of the North can be seen as trans-generational free-riders because they *currently* benefit from *past* emissions that impose costs on people *currently* living in the South. Importantly, Gosseries distinguishes two interpretations of the way in which free-riding can be seen as objectionable. The first interpretation relies on considerations of distributive justice and this is not the relevant case for the BePP. It is the idea sketched a few lines above that, of course, *any* undeserved benefits and harms can be seen as calling for redistribution – and benefits and harms due to injustice committed by others are simply *one* instance of undeserved benefits and harms. But if one relies on this interpretation it is difficult to see what is specific about benefiting from a wrongful action in contrast to benefiting from some other kind of action or event for which one is not responsible. All that one could possibly argue for is that, intuitively, there seems to be weightier reason to even out undeserved deviations from a just baseline which are due to a wrong than to even out undeserved deviations which are due to more general causes. The second interpretation of why free-riding is objectionable relies on what Gosseries calls "interactive justice," which is similar to our conception of compensatory justice. It is the relevant case for making use of BePP to legitimise compensatory payments. This second way gains some plausibility if one regards benefiting from an action or a scheme or a policy as in some way involving an action, namely the action of willingly *accepting* being benefited by it. Accepting being benefited by wrongful emissions can possibly be seen as transferring (some of) the wrongdoer's duty of compensation to the beneficiary. Another basis for the position that benefiting from wrongdoing calls for compensation is proposed by Butt. He claims that condemnation of injustice implies not being willing to benefit from it while others suffer from it: "My claim is that taking our nature as moral agents seriously requires not only that we be willing not to commit acts of injustice ourselves, but that we hold a genuine aversion to injustice and its lasting effects. We make a conceptual error if we condemn a given action as unjust, but are not willing to reverse

or mitigate its effects on the grounds that it has benefited us" (Butt (2007, p. 143)).

Even though we are sceptical of the position that benefiting from wrongful actions not only gives rise to duties of redistribution but also to duties of compensation, we will not commit ourselves to a definite answer. Rather, we will note that *even if* the BePP could be defended as a principle in general, there is still something very questionable about applying it to climate damages. Due to the non-identity problem, North-Young and South-Young (who constitute the people who did not emit themselves) cannot be said be benefited at all. Without past emissions they would not be worse off but rather not exist at all (this is the fifth problem from the above list). And even if the non-identity-problem were less relevant, there still remains an obstacle: If voluntary acceptance of benefits should prove to be a condition of their giving rise to compensatory duties, one would have to address the difficult issue of whether abstaining from emigrating from an industrialised country (or rejecting the benefits of living there in some other way) can really count as willingly accepting these benefits. Thus, although BePP seemingly has a larger base of possible duty bearers than the EmPP – not only the emitters themselves but anybody who benefited from the wrongful emissions – it is no more successful in identifying duty bearers than EmPP.

So, both EmPP and the more questionable BePP can only justify a small amount of compensatory measures or none at all. Let us now turn to the principle that demands that present-day members of a community must pay for the wrongs that past members of the community committed (CoPP). We will not commit ourselves to a certain view as to what the adequate specification of the community would be in the context of climate change but we will use countries or other communities with a legal form as the most suggestive examples.

Note that we in no way presuppose the collective *moral* responsibility of today's people living in the North for the emissions of their ancestors in

the sense that the currently living would be able to incur blame or guilt for past wrongful emissions. We want to place our arguments firmly on normative individualist grounds. (If one was keen on using the language of "collective responsibility" then what we are arguing for is that members of a community can have collective *outcome* or *remedial* responsibility (cf. Miller (2004, pp. 244–47)) for actions of other members of the community, that is: due to their membership in the community they can have a duty to shoulder benefits and burdens which go along with the actions of other members without being in any way morally or causally responsible for these actions).

Taking costs on ourselves due to our membership in a collective (and not due to our own actions) is not something alien to our thinking: Countries pay back debts that the governments of earlier generations have taken up, managers resign from jobs due to mistakes of their employees and Switzerland is faced with demands to compensate victims of World War II long after many people of this era have died. Is this justifiable? Some of the arguments adduced for it rely on non-individualistic premises; some of the arguments are non-starters – such as the idea that simple identification with some community is enough for incurring a duty to compensate others for the community's wrongdoings (Imagine that you identify with a political party without being an official member of it – do you have any moral duty to help pay the fines if its officials accept bribes?); and some of the more successful justifications for duties due to community membership cannot easily be extended to the case of transgenerational communities – such as the idea that people who mutually cooperate with each other and share in a common objective share the duty to compensate others for the wrongs thereby committed (In what way can present Germans be said to cooperate with past Germans in the project of fascism?). There *are*, however, sound arguments to the effect that community membership can, in principle, be a reason to ascribe duties to presently living members of a transgenerational community to provide compensation for the wrongs committed by earlier

members. One can reason as follows (for an extensive treatment, see Meyer (2005, ch. IV and V)):

People can value their membership in certain groups (communities or polities). Accordingly, they will be willing to accept standing under obligations of preserving the group to which they belong. People can have valid reasons for understanding themselves in such a way. First, the group to which they belong might exhibit a general value by being, say, a just or tolerant community. All people have reason to value belonging to such a community insofar as living in, say, a just society is – individually and collectively – of intrinsic value. The groups typically are transgenerational in character: They comprise many generations, have a past and a future. If justice requires, inter alia, providing measures of restitution and compensation for wrongful harm-doing such transgenerational communities will be just, inter alia, by providing compensation to presently living victims of injustices that earlier members of the community committed. Second, people will value their membership in such groups for a further reason: the group might exhibit particular features that are highly relevant for the wellbeing of its members since they manifest particular ways of communal life. Due to these features of their group's culture people have access to particular options that are highly valuable to them given who they are: the particular culture of their group will often have shaped their social identity in decisive ways.

The two types of reasons for holding membership in one's community or polity to be valuable are interrelated: The intrinsic value of our being a member of a society will depend in part on the ways in which we relate to its particular features, yet we clearly do not attribute intrinsic value to just any society. Rather, for a society to have intrinsic value it will have to fulfil certain minimal requirements concerning its internal and external relations. What these minimal conditions amount to will depend on what universal and particularly weighty reasons for action people can be said to have. It seems very plausible to suggest that people ought to value their membership

in a society on the condition that their society is just to a reasonable degree. Thus, for them to be able to attribute intrinsic value to their membership, they will have to contribute to the creation and strengthening of the institutions that are necessary for their society fulfilling its obligations of justice. Arguably, among these obligations are obligations to provide measures of compensation for wrongs that were committed publicly[57] (or even in the name of the community) by its members in the past.

So given that the intrinsic value of communities is only present under certain conditions one has reason to see to it that these conditions are fulfilled. And if one of those conditions is that present-day victims of historical injustice are compensated, one has reason based on valuing the community to do so. Partly, the reasons one has can be understood to reflect the idea of a natural duty to justice: We all have the duty to support the realisation of justice and thus, if membership in a community, and the creation of adequate institutions in this community, and the support of the specific goal of compensation payments to victims of historical injustice are necessary prerequisites for justice becoming a reality, then one has a duty to work towards these goals. This is so not as a matter of personal preference of identifying with one's community but reflects categorical reasons: carrying out the natural duty of justice serves a good, the protection of which is thought to be of such importance that people are thought to have categorical reasons for doing so, that is, reasons whose validity does not derive from the contingent desires of the people on whom they apply. At the same time, since membership in the community is valued in part due to its specific features (its

[57] We will not discuss further what "publicly" exactly amounts to. The basic point is that, of course, a community cannot be held responsible for just any kind of "private" wrong that its members do to members of other communities. The community ties only become relevant when the wrongs that are committed have some public or collective aspect in the sense that the wrong had a pervasive and important place in the community's social structure or was even committed "in the name" of the community. The emission of greenhouse gases and the policies that promote and enable industrialisation clearly seem to fulfill the criterion of being a constitutive element of the community's public and shared way of living. How much someone is emitting is to a large extent not just a personal decision but is strongly dependent on the country's stage of industrialisation.

history and unique communal ways of life it realises), their members fulfilling their duties of justice will reflect their *wanting* to uphold a particular *self-understanding*, namely that of being a participating member of their community. For they understand that they can wish to uphold the particular communal way of life of their society (based, in part, on its particular features) only if their society is sufficiently just. This, arguably, requires the provision of restitution and compensation for wrongs that were committed publicly (or even in the name of the community) by its members in the past. So, the bottom line is that there are ways in which liberals relying on normative individualism can justify why present-day members of countries should accept the duty to make compensatory payments for wrongful emissions of earlier members of the country as demanded by CoPP. Thus, the scope of possible duty-bearers is extended so as to include North-Young and North-Middle paying for the wrong done by the emissions of North-Old. They do this as members of the community of the North.

Note however that compensatory payments along the lines of CoPP still only cover *wrongful* emissions. And thus, emissions made under ignorance about their harmful nature, and emissions that did not exceed the fair share, as well as non-anthropogenic causes of climate change all remain uncovered. Actually, reliance on CoPP can only complement EmPP and BePP in the sense that it escapes the first problem of the above list (that is, potential polluters might be dead) with the other problems remaining unaffected.

4.4.3 Redistribution as a Response to Climate Damages

Compensation payments for climate damages are difficult to justify for the reasons offered above. And, more importantly, insofar as such arguments (for EmPP, BePP, or CoPP) actually succeed in justifying *some* compensatory measures, they only justify them for *part* of those who cause or suffer from climate change.[58]

[58] And if someone holds that more than one of the three principles of compensatory justice is successful in defending compensatory measures for past emissions he still

Still, the fact that the South has to carry such a large share of climate damages seems to be a situation that cries out for *some* kind of response. And of course, compensation (in the narrow sense of wrongdoing persons paying something to the wronged persons on the grounds of the injustice committed) is not the only kind of possible response. Rather, given that many effects of climate change can be seen as undeserved harms – and harms which go along with undeserved benefits for other persons – levelling off such effects *on the basis of a concern for distributive justice* is an equally plausible response. In assuming that the priority view is the correct kind of principle for distributing emission rights we assumed that principles of distributive justice do apply at the global level (see among others Pogge (1989)). And consequently, we believe that principles of distributive justice can also be applied (at least to some degree) to the distribution of duties to pay for adaptation measures to those who suffer from climate damages. Of course, to common moral intuition, demands of compensatory justice seem to have a stronger force than demands based simply on evening out undeserved benefits or harms, particularly at the global level (cf. Miller (2004, fn. 1) and Gosseries (2004, p. 55)). We do not necessarily want to question that view: Compensation payments might have a certain priority before redistributive concerns. However, in the context of climate damages, compensation payments are only justifiable for such a small part of the problem that it is appropriate to direct attention primarily to the redistributive demands. The focus must be turned to sharing undeserved benefits and harms equitably rather than focusing on compensating wronged persons in view of the limited applicability of the latter enterprise.

In practice, a prioritarian redistributive scheme concerned with climate damages would mean that those who are lucky in terms of not being affected

has to define how the three principles complement or replace each other. For example: if one were of the opinion that both the EmPP and the BePP can legitimately be applied, one cannot eschew specifying whether it is primarily the emitter or the beneficiary or both who must shoulder the costs for the compensatory payments (see also Caney (2006b, p. 472)).

much by climate change should assist those who are unlucky in terms of being affected heavily. They owe this assistance *independently* of who caused climate change. Thus according to the redistributive approach to climate damages, even if, contrary to actual fact, it historically were the South who predominantly created the climate problem, it is still those who are vulnerable to a small extent who should support adaptive measures in those countries where people are more vulnerable.[59]

Another way to install a prioritarian redistributive scheme concerned with climate damages would differ from the one just mentioned in not only aiming at a just pattern concerning the specific good called "climate damages" (cf. option 1 from section 4.2.2) but in rather taking into account the whole background distribution of other goods (cf. option 2 from section 4.2.2).[60] Taking into account the background distribution amounts to making the wealthy – that is, the wealthy in general and not only the wealthy in terms of having to cope with few climate damages – assist those who are vulnerable to climate change. Of course, being wealthy and not being very vulnerable is correlated quite strongly, but not perfectly. Insofar as they are correlated, both options – taking and not taking the background distribution into account – primarily make the North pay the bill.

In the real world this would mean that countries have to be ranked according to their vulnerability to climate change and those that are highly vulnerable get privileged access to the resources available in a global adaptation fund. The above argument suggests that such a fund would have to be paid for either by those who exhibit low vulnerability or by the wealthy. To some limited extent, it could also be supplied with payments by those who despite all the problems mentioned in section 4.4.2 stand under com-

[59] In terms of figure 6, enacting a prioritarian distribution between the North and the South of the specific good of climate damages would amount to a transfer of 5 units of benefits from the North to the South.

[60] Instead of going directly from only looking at climate damages all the way to taking into account the whole background distribution of other goods, one might also stop in the middle, so to speak, and at least take into account the already existing inequality in the climatic conditions that people face even without climate change.

pensatory duties. Within countries, raising the money for such a global adaptation fund through progressive taxation could serve as an approximation for making the less vulnerable pay. At the intra-national level, aiming at additional redistribution from the hardly vulnerable to the highly vulnerable might take many different forms, for example government subsidies for adaptation measures in poor communities.

4.5 Conclusion

This chapter discussed a fair way of allocating the mitigation and adaptation costs associated with climate change, in particular in the light of the benefits and damages brought forth by past emissions. It presupposed a prioritarian theory of distributive justice and generally proceeded by abstracting from the background inequality existing in the real world. It first discussed mitigation and concluded that the South should get higher per capita emission rights than the North because it has less benefits associated with past emissions to start with. It then discussed who should come up for adaptation costs and argued that it is difficult to frame the duty of the North to those who are highly vulnerable as a duty of compensation but that it should primarily be seen as a duty grounded in concerns of distributive justice.

Even though we separated the issue of mitigation (sections 4.2 and 4.3) and adaptation (section 4.4) for analytical purposes, there might be ample reason to link the two issues, in particular when it comes to practical policy making. In a "local justice approach" (cf. section 4.2.2) there is no general guideline on which goods to discuss jointly and which goods to discuss separately and it is of course not at all far-fetched to discuss the two climate change related goods of emission rights and climate damages in conjunction, particularly given that we have shown that both primarily pose issues of distributive justice.[61] By treating mitigation and adaptation jointly, one

[61] In terms of figure 6, enacting a prioritarian distribution of both benefits and damages

could for example argue for assisting those with above average vulnerability through the specific "currency" of emission rights. In linking adaptation and mitigation one could also take note of interdependencies, such as the need for economic progress (and thus the need for emission rights) in poor countries in order to diminish vulnerability (and thus adaptation costs). It is also a desideratum to link up the discussion more with the background distribution of other goods, which would in general strengthen the duties of the North even more but would in addition highlight more clearly the duties of wealthy individuals within poor countries. Linking the discussion of climate change related goods more closely to the background inequality would in practice point to the need for linking development and climate policies.[62]

Regardless of which goods are treated jointly both in the policy arena and for purposes of analytical discussion, the message stays the same that almost any argument on climate justice ascribes larger shortcomings to the North than to the South in comparison with the ideally just state of affairs. Since there is not much to dispute concerning this general conclusion, the interest of any argument must lie in the *rationale* it gives for this conclusion. It has been the goal of this chapter to give a plausible justification for this widely accepted claim, in particular by stressing how past emission generating activities yield unequal benefits and harms for the presently living – an inequality which generally calls for the application of distributive justice rather than compensatory justice.

jointly would prescribe giving all the 10 emission rights which are up for distribution in period II to the South and would in addition prescribe a transfer of 2 units of benefits from the North to the South. This would leave the people in the South who are alive in period II (taken as a whole group) with zero net benefits added up over periods I and II. The same would be true for the North.

[62] Posner and Sunstein (2007) ask the following legitimate question: If the higher duties of the North are justified by considerations of distributive justice, and if redistributive goals could more effectively be reached by more general redistributive measures than simply climate change related payments, why narrow the focus down to redistribution in terms of the goods of emission rights and support for adaptation measures?

Bibliography

Anthoff, D., R. Tol, and G. Yohe (2008): "Risk Aversion, Time Preference, and the Social Cost of Carbon," *ESRI Working Paper*, 252.

Anwander, N. (2005): "Contributing and Benefiting: Two Grounds for Duties to the Victims of Injustice," *Ethics & International Affairs*, 19, 39–45.

Arneson, R. (2000): "Perfectionism and Politics," *Ethics*, 111, 37–63.

Arrow, K., W. Cline, K.-G. Maler, M. Munasinghe, R. Squitieri, and J. Stiglitz (1996): "Intertemporal Equity, Discounting, and Economic Efficiency," in *Climate Change 1995, Economic and Social Dimensions of Climate Change, Contribution of Working Group III to the Second Assessment Report of the Intergovernmental Panel on Climate Change*, ed. by J. Bruce, H. Lee, and E. Haites, Cambridge: Cambridge University Press, 125–144.

Baer, P. (2002): "Equity, Greenhouse Gas Emissions, and Global Common Resources," in *Climate Change Policy*, ed. by S. H. Schneider, A. Rosencranz, and J. O. Niles, Washington DC: Island Press.

Baer, P., T. Athanasiou, and S. Kartha (2008): "The Right to Development in a Climate Constrained World: The Greenhouse Development Rights Framework," `http://ecoequity.org/wp-content/uploads/2009/02/thegdrsframework.pdf`, accessed October 10, 2009.

Baron, J. and M. Spranca (1997): "Protected Values," *Organizational Behavior and Human Decision Processes*, 70 (1), 1–16.

Bartsch, U. and B. Müller (2000): *Fossil Fuels in a Changing Climate*, Oxford: Oxford University Press.

Baumert, Kevin, T. H. and J. Pershing (2005): *Navigating the Numbers: Greenhouse Gas Data and International Climate Policy*, Washington: World Resources Institute.

Birnbacher, D. (2003): "Can Discounting Be Justified?" *International Journal of Sustainable Development*, 6 (1), 42–53.

Broome, J. (1994): "Discounting the Future," *Philosophy and Public Affairs*, 23, 128–156.

Butt, D. (2007): "On Benefiting from Injustice," *Canadian Journal of Philosophy*, 37, 129–152.

Cane, P. (1993): *Atiyah's Accidents, Compensation and the Law*, London: Butterworths.

Caney, S. (2005): "Cosmopolitan Justice, Responsibility and Global Climate Change," *Leiden Journal of International Law*, 18 (4), 747–775.

——— (2006a): "Cosmopolitan Justice, Rights and Global Climate Change," *The Canadian Journal of Law & Jurisprudence*, 19, 255–278.

——— (2006b): "Environmental Degradation, Reparations, and the Moral Significance of History," *Journal of Social Philosophy*, 37 (3), 464–482.

——— (2008): "Human Rights, Climate Change, and Discounting," *Environmental Politics*, 17 (4), 536–555.

——— (2009): "Climate Change, Human Rights and Moral Thresholds," in *Human Rights and Climate Change*, ed. by S. Humphreys, Cambridge: Cambridge University Press.

Casal, P. (2007): "Why Sufficiency Is Not Enough," *Ethics*, 117, 296–326.

Christian Aid (1999): "Who Owes Who? Climate Change, Debt, Equity and Survival," `http://www.jubileeresearch.org/ecological_debt/Reports/Who_owes_who.htm`, accessed February 21, 2008.

Commission of the European Communities (2000): "Communication from the Commission on the Precautionary Principle," Brussels: The Commission of the European Communities.

Dasgupta, P. (2007): "The Stern Review's Economics of Climate Change," *National Institute Economic Review*, 199, 4–7.

Depledge, J. (2002): "Continuing Kyoto: Extending Absolute Emission Caps to Developing Countries," in *Building on the Kyoto Protocol: Options for Protecting the Climate*, ed. by K. A. Baumert, O. Blanchard, S. Llosa, and J. F. Perkaus, Washington: World Resources Institute, 31–60.

Dorfleitner, G. and M. Krapp (2007): "On Multiattributive Risk Aversion: Some Clarifying Results," *Review of Managerial Science*, 1 (1), 47–63.

Eeckhoudt, L. and H. Schlesinger (2006): "Putting Risk in Its Proper Place," *The American Economic Review*, 96 (1), 280–289.

Elster, J. (1992): *Local Justice*, Cambridge: Cambridge University Press.

Feinberg, J. (1978): "Voluntary Euthanasia and the Inalienable Right to Life," *Philosophy and Public Affairs*, 7, 93–123.

Ferejohn, J. and T. Page (1978): "On the Foundation of Intertemporal Choice," *American Journal of Agricultural Econonomics*, 60, 269–275.

Fishkin, J. S. and P. Laslett, eds. (1992): *Justice Between Age Groups and Generations*, New Haven, Mass.: Yale University Press.

Friends of the Earth (2006): "Climate Justice: A Fair Share of the Atmosphere," `http://www.foe.org.au/resources/publications/climate-justice/A%20fair%20share%20of%20the%20Atmosphere.pdf`, accessed February 21, 2008.

Gardiner, S. M. (2006a): "A Core Precautionary Principle," *The Journal of Political Philosophy*, 14 (1), 33–60.

——— (2006b): "A Perfect Moral Storm: Climate Change, Intergenerational Ethics and the Problem of Moral Corruption," *Environmental Values*, 15, 397–413.

Gollier, C. and N. Treich (2003): "Decision-Making Under Scientific Uncertainty: The Economics of the Precautionary Principle," *The Journal of Risk and Uncertainty*, 27 (1), 77–103.

Gosseries, A. (2004): "Historical Emissions and Free Riding," *Ethical Perspectives*, 11 (1), 36–60.

——— (2007): "Cosmopolitan Luck Egalitarianism and Climate Change," *Canadian Journal of Philosophy suppl. vol.*, suppl. Vol. 31, 279–309.

——— (2008): "Theories of Intergenerational Justice: a Synopsis," *Surveys and Perspectives Integrating Environment and Society*, 1, 39–49.

Hellwig, M. (2004): "Risk Aversion in the Small and in the Large when Outcomes are Multidimensional," Preprint No. 2004/6, Max Planck Institute for Research on Collective Goods.

Holtug, N. and K. Lippert-Rasmussen, eds. (2007): *Egalitarianism*, Oxford: Oxford University Press.

Howarth, R. B. (1995): "Sustainability under Uncertainty: A Deontological Approach," *Land Economics*, 71, 417–427.

IPCC (2001): *Climate Change 2001: Mitigation*, Cambridge: Cambridge University Press.

——— (2007): *Climate Change 2007: Synthesis Report*, Geneva: IPCC.

Jensen, K. K. (2002): "The Moral Foundation of the Precautionary Principle," *Journal of Agricultural and Environmental Ethics*, 15, 39–55.

Kahneman, D. (2000): "Experienced Utility and Objective Happiness. A Moment-Based Approach." in *Choice, Values, and Frames*, ed. by D. Kahneman and A. Tversky, Cambridge: Cambridge University Press, 673–692.

Kihlstrom, R. E. and L. J. Mirman (1981): "Constant, Increasing and Decreasing Risk Aversion with Many Commodities," *The Review of Economic Studies*, 48 (2), 271–280.

Krebs, A., ed. (2000): *Gleichheit oder Gerechtigkeit?*, Frankfurt: Suhrkamp.

Krysiak, F. C. and D. Krysiak (2006): "Sustainability with Uncertain Future Preferences," *Environmental and Resource Economics*, 33, 511–531.

Kuntz-Duriseti, K. (2004): "Evaluating the Economic Value of the Precautionary Principle: Using Cost Benefit Analysis to Place a Value on Precaution," *Environmental Science and Policy*, 7, 291–301.

La Rovere, E., L. de Valente de Macedo, and K. Baumert (2002): "The Brazilian Proposal on Relative Responsibility for Global Warming," in *Building on the Kyoto Protocol: Options for Protecting the Climate*, ed. by K. Baumert, O. Blanchard, S. Llosa, and J. Perkaus, Washington: World Resources Institute, 157–173.

Laitner, J. and H. Ohlsson (2001): "Bequest Motives: a Comparison of Sweden and the United States," *Journal of Public Economics*, 79 (1), 205–236.

Masson, A. and P. Pestieau (1997): "Bequest Motives and Models of Inheritance: A Survey of the Literature," in *Is Inheritance Legitimate? Ethical and Economic Aspects of Wealth Transfers*, ed. by G. Erreygers and T. Vandevelde, Springer: Berlin.

McCarthy, D. (1997): "Rights, Explanation, and Risks," *Ethics*, 107, 205–225.

Meyer, L. H. (2004): "Compensating Wrongless Historical Emissions of Greenhouse Gases," *Ethical Perspectives*, 11 (1), 20–35.

——— (2005): *Historische Gerechtigkeit*, de Gruyter: Berlin und New York.

——— (2008): "Intergenerational Justice," in *The Stanford Encyclopedia of Philosophy (Fall 2008 Edition)*, ed. by E. N. Zalta, `http://plato.stanford.edu/archives/fall2008/entries/justice-intergenerational`.

Meyer, L. H. and D. Roser (2006): "Distributive Justice and Climate Change. The Allocation of Emission Rights," *Analyse & Kritik*, 28, 223–249.

——— (2007): "Intergenerationelle Gerechtigkeit. Die Bedeutung von Zukünftigen Klimaschäden für die Heutige Klimapolitik." Commissioned Survey for the Swiss Federal Office for the Environment, Bern.

——— (2008): "Klimaökonomische Studien und Intergenerationelle Gerechtigkeit," Ms.

——— (2009): "Enough for the Future," in *Intergenerational Justice*, ed. by L. H. Meyer and A. Gosseries, Oxford: Oxford University Press.

Miller, D. (2004): "Holding Nations Responsible," *Ethics*, 114, 240–268.

Moellendorf, D. (2002): *Cosmopolitan Justice*, Boulder: Westview Press.

Moeller, D. (2006): "Should We Let People Starve – For Now?" *Analysis*, 66 (3), 240–47.

Neumayer, E. (2000): "In Defence of Historical Accountability for Greenhouse Gas Emissions," *Ecological Economics*, 33, 185–192.

Nordhaus, W. (2007): "A Review of the Stern Review on the Economics of Climate Change," *Journal of Economic Literature*, 45 (3), 686–702.

——— (2008): *A Question of Balance*, New Haven: Yale University Press.

Nordhaus, W. D. (1997): "Discounting In Economics and Climate Change," *Climatic Change*, 37 (2), 315–28.

Page, E. A. (2006): *Climate Change, Justice And Future Generations*, Cheltenham: Edward Elgar.

Parfit, D. (1984): *Reasons and Persons*, Oxford: Oxford University Press.

Parfit, D. and T. Cowen (1992): "Against the Social Discount Rate," in *Justice Between Age Groups and Generations*, ed. by P. Laslett and J. Fishkin, New Haven: Yale University Press, 144–161.

Pearce, D., B. Groom, C. Hepburn, and P. Koundouri (2003): "Valuing the Future: Recent Advances in Social Discounting," *World Economics*, 4 (2), 121–141.

Pogge, T. W. (1989): *Realizing Rawls*, Ithaca: Cornell University Press.

Posner, E. A. and C. R. Sunstein (2007): "Climate Change Justice," *University of Chicago Law & Economics Olin Working Paper*, 354.

Quiggin, J. (2008): "Stern and His Critics on Discounting and Climate Change: An Editorial Essay," *Climatic Change*, 89, 195–205.

Rawls, J. (1971): *A Theory of Justice*, Cambridge: Harvard University Press.

Roemer, J. (2004): "Eclectic Distributional Ethics," *Politics, Philosophy and Economics*, 3, 267–281.

Roser, D. (2008): "A Baker's Dozen for Future Generations," Ms.

——— (2009): "Subjective Probabilities and Sensible Precaution," Ms.

Sandin, P. (2004): "Better Safe than Sorry: Applying Philosophical Methods to the Debate on Risk and the Precautionary Principle," Theses in Philosophy from the Royal Institute of Technology, Stockholm.

Schelling, T. (1995): "Intergenerational Discounting," *Energy Policy*, 23, 395–401.

Sen, A. (1982): "Rights and Agency," *Philosophy und Public Affairs*, 11 (1), 3–39.

Sher, G. (2005): "Transgenerational Compensation," *Philosophy & Public Affairs*, 33, 181–201.

Shue, H. (1993): "Subsistence Emissions and Luxury Emissions," *Law and Policy*, 15 (1), 39–59.

Singer, P. (2002): *One World*, New Haven: Yale University Press.

Stern, N. (2007): *The Economics of Climate Change: The Stern Review*, Cambridge: Cambridge University Press.

Sunstein, C. and D. Weisbach (2008): "Climate Change and Discounting the Future: A Guide for the Perplexed," *Harvard Public Law Working Paper*, 08-20.

Sunstein, C. R. (2005): "Cost-Benefit Analysis and the Environment," *Ethics*, 115, 351–385.

——— (2007): *Worst-Case Scenarios*, Cambridge, MA.: Harvard University Press.

Tanner, C., D. L. Medin, and R. Iliev (2007): "Influence of Deontological Versus Consequentialist Orientations on Act Choices and Framing Effects: When Principles Are More Important Than Consequences," *European Journal of Social Psychology*, 38 (5), 757–769.

Thomson, J. J. (1986): *Rights, Restitution, and Risk*, Cambridge, MA: Harvard University Press.

Tol, R. (2008): "The Social Cost of Carbon: Trends, Outliers, and Catastrophes," *Economics – the Open-Access, Open-Assessment E-Journal*, 25 (2), 1–24.

Tol, R. S. J. (2003): "Is the Uncertainty about Climate Change too Large for Expected Cost-Benefit Analysis?" *Climatic Change*, 56 (3), 265–289.

Weitzman, M. (2009): "On Modeling and Interpreting the Economics of Catastrophic Climate Change," *Review of Economics and Statistics*, 91 (1), 1–19.

World Bank (2008): *2008 World Development Indicators*, Washington, D.C.: World Bank.

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